1908.

(SECOND SESSION.)

LEGISLATIVE ASSEMBLY.

NEW SOUTH WALES.

REPORT

OF THE

DEPARTMENT OF PUBLIC WORKS,

FOR THE

YEAR ENDED 30 JUNE, 1908.

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1908.

NEW SOUTH WALES.

THE DEPARTMENT OF PUBLIC WORKS.

(ANNUAL REPORT, 1907-8.)

THE UNDER SECRETARY FOR PUBLIC WORKS TO THE HONORABLE CHARLES ALFRED LEE, M.L.A., SECRETARY FOR PUBLIC WORKS.

Department of Public Works,
Sydney, 15th December, 1908.

Sir,

I have the honor to submit the following report, together with statements from the Heads of Branches, showing the operations of the Department during the year ending 30th June, 1908.

FINANCIAL.

The total expenditure amounted to £2,331,215 3s. 1d., an increase of £349,446 3s. 1d. on that of last year. This sum includes the cost of works carried out for other State Departments amounting to £167,016 7s. 10d. and £30,159 19s. 1d. for work carried out for the Commonwealth Government, also an expenditure of £16,893 7s. 10d. on account of buildings designed and erected by our officers for the Public Instruction Department, but the vouchers for which did not pass through our books.

The cost of administration and supervision which embraces salaries, equipment, and other allowances, rents, telephone charges, postage, cleaning, and caretaking, totalled £162,636 19s. 5d. This represents 6·976 per cent. of the total cost of the work supervised by this Department, and is 1·034 per cent. less than the preceding year.

This percentage would be still further reduced if allowance were made on account of investigations and reports made by Officers of the Department, which occupied much time and involved a considerable expenditure in salaries, &c., but in connection with which no works were directly carried out.

Exclusive of the cost of administration and supervision, the expenditure during the year is distributed as follows:—

	£	s.	d.
Rivers, Water Supply, and Drainage	585,553	17	6
Railways and Tramways	529,834	16	10
State Buildings (Government Architect) ...	492,179	13	2
Local Government (incidental to)	271,192	10	0
Roads, Bridges, and Ferries	160,954	12	8
* Fitzroy Dock	60,975	7	9

The

* As reported by the Dock Managing Committee.

The decrease of £251,376 expenditure in connection with Roads, Bridges, and Ferries, as compared with last year, is almost entirely due to the operations of the Local Government Act.

As the Department has practically ceased to carry out Road Works within the Local Government areas of the State, the total number of contracts let during the year was less by 1,717 than in 1906-7, but the amount covered by the contracts shows an increase of £485,386 3s. 3d. over last year. The work carried out necessitated transactions with 6,585 persons or firms, and involved the preparation, examination, and payment of 45,009 vouchers.

The amount paid during the year for compensation and other expenditure on account of the Darling Harbour and Rocks Resumptions was £65,452 6s. 7d., as against £93,515 16s. 10d. for 1906-7.

The amount paid in wages during the year, exclusive of Officers and Dredge Service employees' salaries and wages, was £317,657 12s. 9d., or an increase of £11,444 2s. 2d. over 1906-7.

The Permanent Staff of the Department on the 30th June, 1908, comprised 395 Officers, at a cost of £102,875, or a reduction of 44 Officers, and £10,300 in salaries, which is due in a great measure to the expiration of leave and subsequent retirement of Officers, due to the introduction of Local Government, many of whom have accepted positions under the Shire Councils.

The Temporary List on the other hand is much larger than in 1906-7. The statement submitted by the Accountant shows that on 30th June there were 346 officers temporarily employed as against 236 last year, and the increase in cost is £20,030.

Stores and Plant.

The number of requisitions received by the Stores branch for all services was 15,856, being 2,376 in excess of those received last year, while 2,031 more orders were issued than in 1906-7. The value of the supplies obtained in this way was £249,705 10s. 8d.

Railway and Tramway Construction.

The work in connection with Railway construction has been carried on continuously throughout the year. The line from Manilla to Barraba was ready for handing over to the Railway Commissioners in September, 1908. The erection of station buildings at Winborne, Upper Manilla, Black Springs, and Barraba is well in hand. Trucking-yards are provided at Upper Manilla and Barraba, and a water supply for locomotives is being erected at the latter place.

The first section of the line from Bogan Gate to Bulbodney was completed and handed over to the Railway Commissioners on the 6th August, 1907. This section extends to Trundle, a distance of 16 miles from Bogan Gate. For the second section, from Trundle to Tullamore (22 miles 17 chains), a contract was let on the 13th March, 1907, and is well advanced.

The remaining length of 41 miles of the Temora to Barellan line was finished and handed over to the Railway Commissioners on the 15th June, 1908.

The portions from West Narrabri to Cryon on the Walgett line and from Burren Junction to Collarendabri East have been opened for traffic. The section between

between Cryon and Walgett is now nearing completion. The extension of the railway to the Namoi River, at Walgett, increased the work very materially, and the floods of March, 1908, made it necessary to largely increase the waterways and raise the enbankments. The completion of the line has been very much delayed by these additional works.

A small extension of 60 chains of the railway to the Necropolis was carried out, and handed over to the Commissioners in May last.

On the 13th November, 1907, a contract was accepted for the construction of an extension of the Belmore railway as far as Chapel-road, a length of 3 miles 31 chains. This is being built as a main line, and is part of a projected railway to connect with the Southern Line at or near Liverpool. Satisfactory progress is being made with the work.

In regard to the line from Mudgee to Dunedoo, a contract was let on the 27th November, 1907, for the first section from Mudgee to Gulgong, 20¼ miles. The work is being rapidly pushed on, the earthworks are practically finished, and the bridge work well in hand. The survey is completed, and plans and specifications are in hand for the second section from Gulgong to Dunedoo, about 29½ miles.

It has been decided to divide the construction of the North Coast Railway into sections, the first being from West Maitland to Dungog, a length of about 32¾ miles; the second from Dungog to Gloucester, 39½ miles; and the third from Gloucester to Taree, 44 miles 6 chains.

No action has yet been taken in regard to the remaining length of the line Taree to Grafton, 197 miles.

The permanent survey of the first and third sections was completed during the year, and the survey of the second section is well advanced.

In November, 1907, a tender at £15,050 was accepted for the metal work for bridges over the Hunter and Paterson Rivers, and on the 28th April, 1908, a contract (£298,235 15s.) was entered into for the construction of the first section of the line. The contractor commenced work on the 20th May, 1908.

This will be a first-class single line of railway, fully ballasted and laid with 80 lb. silicon rails.

Authority has been given by Parliament for the construction of a line from Lockhart to Clear Hills, a length of 50 miles, at an estimated cost of £149,681.

Authority has also been given for the construction of a line from Narromine to Peak Hill, a distance of 36 miles, at an estimated cost of £121,317.

During the year 85 miles of lines were levelled and permanently staked, 1,406¾ miles of trial lines were surveyed or explored, and inspections were made of 535 miles.

In last report I stated that in Tramway Construction ten new lines or extensions were in progress; of this number the following have been completed and handed over to the Railway Commissioners :—

Adamstown Junction to the Racecourse, Newcastle.
Concord to Cabarita.
Broken Hill Extension to The Oval.
Lillie Bridge to Balmain-road, first section.

The

The following tramways are at present under construction :—

Bellevue Hill.
Enmore-road, *via* Addison-road, to Dulwich Hill.
George-street, *via* New-street, to Erskineville.
East to West Maitland.
Watson's Bay extension, through Gap Park to Clovelly.
Queen-street, *via* Ocean-street, to Waverley.
Willoughby to Chatswood.

Estimates have been prepared and preliminary investigations made for thirty-three tramway extensions, and approval has been given for fifteen extensions to be carried out, for which plans and specifications are in hand, and tenders for some of these will shortly be invited.

Public Buildings.

The aggregate expenditure during the year on Public Buildings, as reported by the Government Architect, is £509,073 1s. This sum includes £16,893 7s. 10d. on account of buildings for the Public Instruction Department, the plans and specifications for which were prepared, and the work supervised, by officers of this Department, but the vouchers did not pass through our books. The total expenditure as shown, represents an increase of £158,345 3s. 5d. over last year.

The erection of the Mitchell Library intended to form a portion of the New National Library, was completed and taken over by the Trustees in March last.

Important improvements have been carried out at the Parliamentary Buildings during the year, and plans are now in hand for remodelling the Council Chambers and Offices, and rebuilding the Macquarie-street, front.

The extensive buildings for Police Barracks, Redfern, were completed during the year, and handed over to the Police Authorities.

The original intention of the Prison Department was to complete the buildings in the Female Prison and the Penitentiary at Long Bay by prison labour, but this having been abandoned, contracts have been entered into for the erection of No. 3 workshop block and the matron's quarters, and plans are now in hand with a view to inviting tenders for the remaining buildings.

Plans for the various buildings in connection with the new abattoirs are nearing completion, and tenders will be invited as soon as the branch railway to the site—now being carried out by the Railway Commissioners—can be made available.

Considerable progress has been made during the year with the erection of the Hospital for Consumptives at Waterfall, and a water supply has been installed by pumping from Waratah Rivulet.

The Russell Engineering School building, referred to in my last report, has been completed, and handed over to the University authorities, and a contract for £3,679 was let on the 24th April, 1903, for the erection of workshops adjoining the school.

In connection with the "Rocks" resumptions, the Department during the year, erected thirty-two model dwelling-houses in Windmill-street, and nine dwelling houses in Upper Fort street, at a cost of £13,106 2s. 1d. and £8,035 9s. 2d. respectively,

respectively, and these have all been let at satisfactory rentals. A contract for £14,539 has been entered into for the erection of eight shops in George-street North.

A large amount of work has been rendered necessary in carrying out alterations and additions to the school buildings throughout the State, so as to adapt them to the new conditions, and every effort is being made to have the buildings as suitable in all respects as possible.

Rivers, Water Supply, and Drainage.

The Report submitted by the Acting-Chief Engineer for Rivers, Water Supply, and Drainage, Mr. E. M. de Burgh, covers a very large and varied range of work, including Harbours and Rivers, Country Towns Water Supply, Sewerage Construction and Irrigation, and several matters of special importance, such as the completion of the Cataract Dam for the Sydney Water Supply, the progress of the work in connection with the Northern Murrumbidgee Irrigation Scheme, and the Barren Jack Dam.

Sydney Water Supply.—The work in connection with Cataract Dam, was finally completed and handed over to the Metropolitan Board of Water Supply and Sewerage on the 10th June, 1908. The main work was finished at a much earlier period, and the dam was used for the purposes of storage. The water thus stored has been used to supplement Prospect Reservoir, and has been found of great benefit in providing an adequate supply to the city. On the 30th June, 1908, the depth of water at the dam was 106·67 feet, and the volume stored amounted to 4,371 million gallons, out of a total of 21,411 million gallons which the reservoir will contain when full.

The completion of this reservoir has made provision for the immediate needs of the city and suburbs, but in view of the great increase of population in the County of Cumberland, the rapid growth of the city in recent years, and the probable increase in the demand for water for domestic and manufacturing purposes, instructions were issued for investigating further sources of supply, and sites suitable for additional storage reservoirs have been surveyed, and the preliminary investigations will be made in anticipation of placing the work of construction of another large reservoir in hand as soon as the requirements warrant it.

Warragamba Water Supply Scheme.—The supply available from the catchment area reserved in connection with the Sydney Water Supply will not, it is anticipated, be sufficient in the future for the County of Cumberland, and an investigation has been made of a scheme to utilise the enormous volume of water from the catchment of the Nepean and Warragamba Rivers above Penrith, which showed that, from a catchment of 3,383 square miles, an enormous supply of water could be delivered to the Central Cumberland districts at a point some few miles above Penrith. The necessary surveys and information to enable the scheme to be worked out are now being obtained.

Northern Murrumbidgee Irrigation Scheme.—Operations at Barren Jack Dam have been making steady progress throughout the year. A diversion channel, capable of carrying approximately 8,000 cubic feet per second, has been excavated through the solid rock on the right bank of the river, and concrete diversion dams have been constructed across the channel both up-stream and down-stream of the

dam

dam site, with the result that the ordinary flow is entirely diverted from the river bed, where operations can now be carried on free from interruption in times of considerable flood. Lidgerwood cable-ways, having a span of 1,200 feet and being capable of lifting 10 tons at the rate of 200 feet per minute, will be installed for handling the material. The foundation for the structure has now been exposed from side to side of the river, and the anticipations as to its satisfactory character have been more than realised. For the conveyance of material to the site of the dam a 2 feet gauge railway has been constructed from Goondah on the Southern line, a distance of 26 miles, a full description of which will be found in the Acting Chief Engineer's Report.

The work of constructing the main canals and diversion works in the vicinity of Narrandera in connection with the scheme has been pushed on very rapidly. The diversion weir and canal head-gates at Berembed, some 20 miles above the town at Narrandera, are well advanced, the work of excavating the main canal has been progressing steadily, and is, together with protecting flood banks, completed to full size for a short distance above, through, and below Narrandera, in all about 5 miles. A further section of about 5½ miles above Narrandera is under construction and nearly finished, while the largest of the flood banks between that point and the town has been constructed.

The Narrandera regulator is a concrete structure, having five quadrant gates, each 12 feet in width, and also carrying a highway bridge. This regulator has been completed, as have five highway bridges and two smaller bridges. In addition to the works actually finished, contracts have been let for the construction of another regulator at Bundidgerry, about 5½ miles above Narrandera. A further length of 15 miles of canal is being advertised for contract, while an additional length of 20 miles, as far as Mirrool Creek, is in preparation.

The first of a series of experimental irrigation farms, which it is proposed to establish along the line of the canal for the education and information of settlers, has been located about 14 miles west of Narrandera and alongside the Yanko Siding on the South Western railway line; 300 acres of land has been resumed, cleared, fenced, and ploughed, and is now under the control of the Department of Agriculture.

Macquarie River Improvements.—A preliminary investigation has been made with a view to initiating works for the regulation of the flow of the Macquarie River and impounding of flood-waters thereon for the purpose of supplying water for irrigation, stock, and domestic use upon the lower river.

Preliminary surveys have been made at a suitable site for a storage reservoir at the junction of the Macquarie and Cudgegong Rivers, but the matter has not yet proceeded sufficiently far to enable any estimate of the probable cost of the necessary works to be made.

Lachlan River Improvements.—An investigation similar to that undertaken with regard to the Macquarie River is in hand for the improvement of the Lachlan. A certain amount of work has been done in the past in connection with the improvement of this river, but the main problem of providing storage has not yet been dealt with. In this connection, surveys have been made for a large storage reservoir at Wyangala, and it is anticipated that a scheme may be drawn up with respect to the regulation of the flow of the river, which will greatly benefit the country through which it passes.

Sewerage of the City of Sydney and Suburbs.—The growth of the eastern and Illawarra suburbs, together with the complaints which have arisen with regard to the sewerage farm at Arncliffe, necessitates the adoption of some improved scheme for the disposal of the increasing volume of sewage now treated at the Arncliffe farm. A scheme for carrying the sewage from the southern and western outfalls and the Illawarra and Botany districts, by discharging through a gravitation sewer into the ocean in the vicinity of Long Bay headland, was brought forward by the Chief Engineer for Rivers, Water Supply, and Drainage, and formed the subject of an exhaustive investigation by the Public Works Committee. Opposition to this scheme was shown by witnesses from outside the Department before the Committee, on the ground that the gradient of the proposed sewer was too flat, and the point of discharge too low, to admit of its effective working. In view of this opposition, and seeing the magnitude of the interests involved—the scheme being estimated to cost about £452,000—the Minister decided to obtain the opinion of three of the highest authorities on sewerage and hydraulics in England upon the departmental proposal. It is satisfactory to find that this opinion which has now been received declares the scheme, with slight modifications, to be entirely practicable; and although the investigation by the Public Works Committee has not been completed, it may be anticipated that the endorsement of such eminent authorities will remove any difficulty in the Committee's approving of a proposal which will tend to the great improvement of the sanitation of the city and suburbs.

In the metropolitan area storm-water channels have been constructed from Alt-street to Orpington-street, Ashfield; James-street, Rookwood; Little Coogee Valley, and Stanmore-road, Marrickville.

The low-level sewerage of the western suburbs of Sydney is being extended to the Iron Cove Creek Valley. It is proposed to place the pumping station on a site near the creek about a quarter of a mile north of the Parramatta-road. The pumping machinery will consist of centrifugal pumps, vertically driven by electric motors, current for which will be obtained from the Railway Commissioners.

Excellent progress has been made with the work of sewering Parramatta. The septic tanks, filters, and pumping station are nearing completion, while fully one-third of the main lines of sewer and reticulation is ready for use. The sanitation of this town is a matter of great importance, not only with regard to the health of its inhabitants, but also having in view the necessity for the improvement of the condition of the Parramatta River by the elimination of untreated sewage from its waters.

Newcastle Sewerage.—The main gravitation sewer which carries the sewage of Newcastle to the ocean having been completed last year, the work of dealing with the connecting sewers has been rapidly pushed on, and steps are being taken now to deal with the construction of the Waratah main sewer, and also with the lower levels of the city. The Acting Chief Engineer reports that the nature of the ground is such as to render the sewering of the lower levels a work of considerable difficulty, and extensive surveys have been required in order to enable the scheme to be dealt with. These preliminaries having now been disposed of, good results in connection with the completing of the work are to be anticipated in the future.

Country

Country Towns Water Supply and Sewerage.—There has been a marked increase in activity in this branch during the past year, and the number of towns desirous of availing themselves of the benefits of the act is increasing—so much so that the demands made upon the staff in this respect have been very heavy.

Under the terms of the "Country Towns Water Supply and Sewerage Act," works for the supply of water to Katoomba have been finished and handed over to the local municipal council. Additional works for water supply have been constructed in the following towns:—Lithgow, Warren, Ballina, Jerilderie, Casino, and Tamworth, and at the close of the year (30th June, 1908) works for providing a water supply or adding to the existing supply were under construction in the following towns:—Cowra, Corowa, Ballina, Gunnedah, Gundagai, Mittagong, Murwillumbah, Lismore, Wellington, and Cootamundra. Extensions of the sewerage works at Narrandera have been carried out at a cost of £830.

Investigations have been made and sewerage schemes prepared for the towns of Goulburn, Wagga Wagga, Albury, Katoomba, Lithgow, and Tamworth.

Works under "Water Supply and Drainage Act."—With reference to swamp drainage, surveys have been made for the preparation of thirteen trust proposals under the "Water and Drainage Act," and six trusts for drainage works have already been gazetted.

During the year trusts have been constituted in connection with twelve bores, which will provide water for an estimated area of 920,960 acres. The total cost of these works is £46,468, or an average of 1s. per acre. (Average rate per acre at 6 per cent.—0·7266d. for twenty-eight years.)

River Gauging.—In the matter of River Gauging, since the beginning of the year, 192 separate observations have been taken at thirty-seven gauging sites, distributed over eighteen main rivers and tributary streams.

Harbours and Rivers.—The navigation of the various rivers has been fairly well maintained throughout the year, principally through the continuous dredging operations which have been carried on; but experience gained from year to year proves conclusively that, at best, the dredging only gives temporary relief, and permanent improvements to the various entrances cannot be looked for until the construction of the training-walls and breakwaters is finished in accordance with the approved designs.

In the cases of the Tweed, Bellinger and Manning Rivers, where the entrances had shoaled, it was found impossible to give relief, even with the shallow-draught bar dredges, owing to the small depth of water on the bars, narrowness of the channel, or other unfavourable conditions.

The Breakwaters and training-walls at the Richmond River, Newcastle Harbour, Port Kembla, Crookhaven River, and Moruya River, were extended during the year a total distance of 2,260 feet. This length is somewhat less than in previous years, owing chiefly to the deeper water in which the walls have been constructed.

During the year a total of 6,092,684 tons of material was dredged from the various rivers.

At the Richmond River work has been confined to the southern breakwater, where 33,769 tons of stone have been deposited in place, extending the breakwater 100 feet, or to a distance of 8,235 feet from the original high-water mark, leaving 320 feet to complete.

The

The question of extending the breakwaters at the entrance to the Clarence River has been referred to the Parliamentary Standing Committee on Public Works, and an inquiry is now proceeding.

No work, beyond dredging and maintenance, has been carried on during the year at the Bellinger, Nambucca, Macleay, Hastings, and Manning Rivers, and at Camden Haven and Cape Hawke.

Operations at the entrance to Newcastle Harbour were suspended in September, 1907, when the authorised limit of expenditure was practically reached. During the year (ending 30th June, 1908), the northern breakwater was extended 20 feet, with 4,829 tons of stone, of from 3 to 30 tons in weight. The length added to the southern breakwater was 25 feet, in which 6,895 tons of stone, of from 8 to 30 tons weight were used. The depth of water at the tip head was about 36 feet at low tide. Submarine rock excavation in the inner basin has been continued throughout the year, the areas excavated being 492 feet x 25 feet to 25 feet deep; and 525 feet x 25 feet to 20 feet deep; the quantity, exclusive of silt, being 10,019 tons.

Fifteen acres of land were reclaimed at North Carrington by sand-pump dredge, most of which has been taken over by the Railway Commissioners in connection with their new compound.

At Port Kembla the eastern breakwater has been extended 315 feet, which required 92,289 tons of stone.

A contract was let, in January last, for the erection of a jetty between the eastern breakwater and the Mount Kembla Company's jetty, for use principally by the Australian Smelting Company and the Electrolytic Refining and Smelting Company.

The Numba Point training-wall was extended up-stream to the Comerong ferry crossing, a distance of 1,800 feet, the weight of stone deposited being 5,600 tons.

The work of extending the lower southern training-wall, Moruya River, was re-started in February last, and the wall advanced about 1,000 feet, with 11,960 tons of stone.

Water Conservation Board.

Reference was made in my last report to the Amending Water and Drainage Act, which, *inter alia*, provides for the granting of licenses for new artesian wells, and for deepening existing ones. The Board constituted under this Act conduct inquiries, deal with issues of licenses, alteration of boundaries of Trust Districts, and matters relating thereto.

Twenty-two meetings were held during the year. Petitions were received against the constitution of the following water-trusts:—Gil Gil Bore, Drildool, Tuppal Creek, Bald Hill Bore, and Bullatale Creek.

A local inquiry was held in each case, the result being that it was decided to constitute all the trusts named with the exception of Bald Hill. In this case, in view of the opposition of the land-holders, it was decided not to take any further action.

From the passage of the Act (29th December, 1906) to the 30th June, 1908, 26 applications for licenses were received, of which 25 were granted, viz.:—21 for new artesian wells, and four for deepening existing wells, one being undealt with at end of year.

The

The Act provides that a public inquiry must be held in regard to each application, and in this connection it might be pointed out that advantage has been taken of the power vested in the Board to authorise some person to hold the inquiry. It has therefore been the practice to delegate this duty to the District Works Officer, and the expense of conducting these inquiries has been thereby reduced to a minimum.

Roads and Bridges.

The total expenditure during the year on account of national works, roads for closer settlement, and tourist traffic within the shire area, and roads, bridges, ferries, and public watering places in the Western Division, amounted to £165,797 12s. 8d. Included in this total is the sum of £21,697, which was paid in connection with road contracts which were unfinished when the shires assumed control, and also an amount of £4,843 for work carried out for the Lands Department.

Tenders were accepted for nine new bridges, representing a total value of £28,120. A contract was also let for alterations to the existing bridge over the Nepean River at Penrith which, in addition to ordinary road traffic, has for nearly forty years carried the main Western Railway. On completion of the new railway bridge in June, 1907, the old bridge was taken over by this Department and arrangements made for its conversion to purposes of general road traffic. These alterations involved the reconstruction of the entire deck system. The old timber deck on the iron spans was removed and reinforced concrete laid upon the cross girders and covered with tarred metal.

In addition to a footway of about 5 feet on the up-stream side the alterations when complete will give a roadway a little over 20 feet wide. Traffic was formerly confined to a track about 6 ft. 6 in. wide, and as vehicles could not pass on the bridge, much inconvenience frequently resulted. The deck on the approach spans has also been renewed and suitable approaches constructed.

At the close of the year tenders had also been invited, or plans were in hand, for eight new bridges estimated to cost £26,983, the most important being the high-level bridge at Scabbing Flat, on the Macquarie River, and the bascule bridge across the entrance to Lake Macquarie, at Swansea. Preliminary information and estimates were furnished and construction approved of seven additional structures, which are estimated to cost £17,950.

In connection with the roads leading to and within closer settlement areas, about 40 miles of new roads were laid out on the Dorrigo, and a total length of about 40 miles on the scattered areas of the Tweed district; a large amount of grading and exploratory work was also undertaken.

The new road from Jindabyne to the summit of Mount Kosciusko (7,328 feet above sea-level) is practically completed, and a good route is now available for vehicular and motor traffic, the distance being about 31¼ miles from Jindabayne.

A bridle-track 8 miles in length from the top of Kosciusko has been formed, returning by a loop to the main road at Charlotte Pass, 4½ miles below the summit. An approach has thus been provided to the Blue Lake and other points of interest.

There are 201 public watering-places in the Western Division. Of this number 101 are leased for sums varying from 1s. to £151 per annum, representing a total rental

rental of about £2,351. Forty-five are worked under contract at rates varying from £1 to £60 per annum, the total amount paid as subsidy being £1,259. The remaining fifty-five are either open watering-places or have been recently proclaimed, and a tenancy has yet to be arranged.

The national ferries now number eleven. Approval has been given to replace the present punt at Coraki, which has been found insufficient for the growing traffic, with a new punt to be driven by steam, at an estimated cost of £1,825.

Local Government.

Under the classification of Shires, made on the 31st December, 1906, in terms of the Local Government Act, eighty-seven were entitled to receive endowment, and the amount paid to these shires for the year 1907, based on the estimated revenue from a rate of 1d. in the £ on the unimproved capital value of the areas was £179,135. The endowment for 1908 will be paid on the actual amount of rates collected during the year 1907, and as several councils levied a higher rate than 1d. in the £, and the actual revenue exceeded the departmental estimate for classification, the amount to be paid for the current year will exceed the sum issued for 1907 by about £42,065.

In addition to the endowment, special grants amounting to £93,000 have been made to Shires, and £54,000 to Municipalities.

During the year the government decided to abolish all tolls on ferries, and arrangements were made to recoup the councils for the net loss resulting from the change.

Four applications were received for the creation of new municipalities, one of which, Mullumbimby, was granted after full inquiry, but in the other three cases the applications were not approved. Four towns petitioned that they be dissolved and incorporated with the surrounding shires. After due consideration, the Municipalities of Gosford and Hill End were dissolved and added to the Shires of Erina and Turon respectively. In the other cases it was decided to allow the matter to remain in abeyance for the present.

As a result of the complete audit which the regulations now require to be made of the accounts of councils, and the examination made by the Local Government examiners, four cases of defalcations were discovered. Under the strict supervision which is now exercised over the councils' accounts it is expected that if irregularities exist they will be discovered at the period of audit, and as the councils' officers do not know when they may receive a visit from the examiner, the opportunities for defrauding the councils are reduced to a minimum.

The interests of the taxpayers are now conserved with respect to loans, as before any such are authorised strict investigation is made and a poll taken.

The work of consolidating, arranging, and revising the ordinances, which was in hand at the date of my last report, has been completed, and the revised ordinances were proclaimed in the Government Gazette of the 14th May, 1908. Similar work in connection with the regulations has now been completed and will shortly be proclaimed.

Government Dockyard, Biloela.

The Managing Committee of the Government Dockyard, Biloela, reports that the volume of work has been considerably increased during the past twelve months, the

the total expenditure being £60,975 7s. 9d., as compared with £40,058 in 1906-7. An additional amount of £11,603 17s. 3d. was expended in connection with necessary additions and improvements to the Dockyard.

During the year a building slip has been constructed with capacity for vessels up to 400 feet long, and the smaller vessels of the service can now be expeditiously repaired without the expense of docking.

The work of converting the dredge "Jupiter" to a self-propelling pump dredge, with independent pumping plant, was effected at a cost of £13,685.

A contract was entered into with the Federal Government for the construction of a Fisheries Investigation vessel, and good progress has been made with the work.

The total tonnage of all vessels docked was 90,194, being almost the same as last year. With the exception of dues received from merchant vessels, practically the only charges made are those covering the actual cost of the work together with the maintenance of the establishment, consequently the actual receipts from docking only amounted to £913 13s. 11d.

Survey Branch.

The work of the Survey Branch has been somewhat retarded owing to the scarcity of suitable and qualified surveyors, and the services of a number of private surveyors, both in the city and country, have been availed of, more particularly in the acquisition of lands, in order that the staff surveyors could devote their attention to surveys required for engineering proposals.

Survey Drawing Office.

This branch deals with preliminary investigations and completing surveys in connection with water conservation, railways, tramways, country towns water supply and sewerage, public watering-places, trust proposals under the Water and Drainage Act, and other works; preparation of finished plans and sections and earthwork quantities, &c. A large amount of miscellaneous matters, including land questions, are also dealt with. The average number of draftsmen, searchers, &c., employed during the year was about fifty, being an increase of twenty on the number employed during the previous year. The work at present in hand, and in view, indicates that it may be necessary to still further increase the staff in the near future.

Engineering Drawing Office, and Iron Work Inspection.

There has been a large increase in the work of the engineering drawing office, necessitating the employment of a number of temporary draftsmen. The value of the works for which designs were prepared and sent on for tenders, or put in hand by day-labour during the year, i £843,936, as against £465,766 during the previous financial year. These figures do not include the value of schemes for which preliminary investigations only were made, as, for instance, the preparation of schemes for the Royal Commission upon the Sydney and North Sydney connection, which were entrusted to the head of the engineering drawing office to prepare. As an index of the expansion in the work of the Department, it might be stated that it has been necessary to increase the engineering drafting staff from twenty-five officers on the 30th June, 1906, to fifty-six officers at 30th June, 1908. Notwithstanding this

this large addition to the Staff, the cost of preparing designs is somewhat lower than last year, amounting to only 1·34 per cent., taking the total amount of salaries paid on the value of the works actually carried out. This result, though satisfactory, would be further reduced if the cost of preparing preliminary schemes, such as those above referred to, and miscellaneous works not carried out, were taken into account.

The various shops where ironwork is manufactured for Government contracts have been very fully occupied during the past year; and it has been found necessary to increase the staff of Ironwork Inspectors from five to six. Among the principal works in progress of manufacture are the steel bridges for the first section of the North Coast Railway, and the steel-truss road bridge over the Richmond River at Casino.

There has been a large increase in the amount of cast-iron pipes, valves, and specials supplied from Messrs. G. and C. Hoskins' foundry. The value of the output has been £51,104 as against £30,796 during the preceding year. The cost of inspection of this material has been 1·06 per cent.

At the date of my last report the blast furnace at Eskbank had only recently been brought into operation and supplies had been drawn only to a limited extent from Lithgow of iron and steel manufactured from the native ores under the "Steel and Iron Contract." This contract, which was originally let to Messrs. William Sandford, Limited, on the 1st January, 1907, for a period of seven years, was transferred to Messrs. G. and C. Hoskins for a period of nine years from 1st January, 1908.

Since taking over the works Messrs. Hoskins have made a number of changes in the plant and arrangement of the rolling-mills, and these were still in progress at the close of the financial year. Portion only of the supplies covered by contract have up to the present been drawn from Lithgow, owing chiefly to the fact that the sheet mill and galvanising shop have been closed down, and rolls for the larger section have not yet been installed pending completion of a large rolling-mill which has been imported by the new firm.

Notwithstanding the delays, however, there has been supplied from Lithgow during the last year, material of the value of £118,744 5s. 1d. for the use of the State Government Services generally. Conferences have been held upon several occasions of representatives from the Chief Railway Commissioner, the Sydney Harbour Trust, the Metropolitan Board of Water Supply and Sewerage, and from this Department, when various matters affecting the conduct of the contract have been discussed and dealt with.

The machine shop at the Government Testing Office at Lithgow has been equipped with a gas-engine, machinery for preparing specimens for testing, and a 100-ton Riehle testing machine. The staff of the testing office has been increased to eight officers, including the Testing Engineer, and a complete card system of records has been installed. The cost of inspection, including the preparation of test specimens by Messrs. G. and C. Hoskins prior to the installation of machinery at the testing office, has been 1·20 per cent.

Land Valuer.

From the Land Valuer's report attached, it will be seen that the year has been a busy one in his branch. Eighty-seven cases standing over from previous years

years have been finally settled; 139 valuations in various parts of the State have been made; and 178 cases were advanced to a stage for valuation. At the request of the Department of Lands, Mr. Sievers superintended the conduct of the Peel River Estate inquiry; and, with the Government Architect, acted as joint valuer of the State properties, which have been transferred to the Federal Government.

Communication Between Sydney and Northern Suburbs.

On the 11th May, 1903, a Royal Commission was appointed by the Government to make full and diligent inquiry into the expediency of providing increased and improved facilities of communication between Sydney and the suburbs on the northern side of Sydney Harbour, from the point of view of passenger, vehicular, and freight traffic, and to suggest the best practicable method of establishing direct communication between the northern and southern sides of the harbour, which would at the same time avoid obstruction to harbour navigation, and also to state the best route for such direct communication.

The gentlemen appointed to the Royal Commission consist of M. E. Kernot, Esq., M. Inst. C.E., Chief Engineer Railway Construction, Victoria (President); H. Deane, Esq., M. Inst. C.E.; and C. N. J. Oliver, Esq., C.M.G. (Members).

The Royal Commission has examined about sixty witnesses, the evidence obtained being of a very comprehensive character, embracing the views of a number of leading departmental officers, professional men, shipping companies, carriers, and business men, military and naval officers, promoters of schemes, and representatives of the travelling public. Evidence has also been taken as to the probable increase in values of property if direct communication were afforded, and as to its effect on the value of Crown lands and reserves. The Commission has made a number of personal inspections of the districts to be served, for the purpose of ascertaining the existing traffic requirements, and its probable development in the future.

At the request of the Commission, levels are being obtained and borings taken across the harbour, in connection with the preparation of designs and estimates for tunnel schemes upon the various lines indicated by the Commission. The work has been entrusted to officers of this Department acting under the direction of Mr. H. H. Dare.

City of Sydney Improvement Board.

On May 14th, Letters Patent were issued by His Excellency the Governor appointing a Royal Commission to investigate proposals for the improvement of the City of Sydney and its Suburbs. The Commission consists of the Right Honorable Thomas Hughes, M.L.C., Lord Mayor of Sydney; the Honorable E. W. Fosbery, C.M.G., M.L.C.; Mr. Henry Gorman; Sir James Graham, M.D., M.L.A.; Mr. R. R. P. Hickson, M. Inst., C.E.,; Mr. J. S. T. McGowen, M.L.A.; the Honorable E. W. O'Sullivan, M.L.A.; Mr. E. A. Scott; Mr. Norman Selfe, M. Inst., C.E. M.I.M.E.; Mr. James Wall; and Mr. John Wheeler; with Mr. D. J. Quinn as Secretary.

Meetings are held in the Board of Reference Room, Department of Public Works, and a vote will be taken on estimates to meet the cost. The Commission is authorised to "diligently examine and investigate all proposals that may be brought forward for the improvement of the city of Sydney and its suburbs; to fully inquire into the whole subject of the remodelling of Sydney, not only in view of the present circumstances of the State and the existing requirements of the

city

city and suburban population, but also in view of the progress of the country, the extension of the metropolis and its suburbs, and the increase of population and traffic within the next twenty-five years; also to consider the expediency of constructing such lines of railway and tramway as may be necessary to meet the increasing demands of traffic; of widening existing streets, and of opening up fresh avenues of communication; and generally, to make such suggestions as to ornamentation and improvements as will tend to add to the attractions and beauty of the city and adjoining suburbs." Much evidence has been taken and valuable information obtained since the Commission began its sittings on 3rd June, but owing to the wide scope of the inquiry, it has been found necessary to ask for an extension of three months of the period allowed the Commission in which to furnish its report.

The services of Mr. R. S. Wilson, survey draftsman, and Mr. C. Coulter, architectural draftsman, have been placed by the Department at the disposal of the Commission.

It will be seen that the past year has been an exceptionally busy one, and the extent and variety of the work involved has called for close application on the part of officers in all branches. I am glad to be able to report that all have shown that satisfactory and intelligent interest in the work which is so essential to the successful conduct of a large department.

I have the honor to be,
Sir,
Your obedient servant,

W. J. HANNA,
Under Secretary.

Accounts Branch, 1907-8.

I HAVE the honor to submit the Annual Report of the Accounts Branch for the year ending the 30th June, 1908.

The expenditure passing through the Head Office for the year, after allowing for credits and transfers, totalled £2,314,321 15s. 3d. This does not include the disbursements of the Metropolitan Board of Water Supply and Sewerage, or those of the Hunter District Water Supply and Sewerage Board, which are dealt with by the respective Boards.

A comparative statement of the volume of business for the past four years is shown in the following table, and indicates an increased expenditure during 1907–8 of £393,841 9s. 1d. over that of 1906–7. It is to be noted that while the expenditure on Roads has decreased owing to the operations of the Local Government Act, the disbursements on other classes of works, especially on Tramway Construction, Public Buildings, Barren Jack Reservoir, and Local Government, have materially increased.

Year.	Number of Persons or Firms dealing with Department, exclusive of Officers or Wages Men.	Number of Pay Vouchers of all Descriptions.	Expenditure.						
			Loans.	Revenue.	Public Works Fund.	Miscellaneous.	Special Deposits.	Other Departments.	Total.
			£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1904-5	5,297	40,840	812,680 4 7	709,205 16 2	.....	35,750 11 5	.....	169,894 2 8	1,727,530 14 10
1905-6	5,244	43,831	743,943 7 10	789,449 7 11	.....	11,540 13 11	38,986 7 0	117,121 15 2	1,701,041 11 0
1906-7	5,661	44,280	659,705 4 4	814,546 5 4	240,847 8 7	28,068 9 8	23,428 13 5	153,884 4 10	1,920,480 6 2
1907-8	6,585	45,009	823,049 3 7	560,002 18 8	685,091 17 7	18,588 12 9	16,400 0 6	211,189 2 2	2,314,321 15 3

The following Summary shows the expenditure under the various heads of service :—

SUMMARY of Expenditure for Year ended 30th June, 1908.

Head of Service.	Loans.	Revenue.	Public Works Fund.	Miscellaneous	Special Deposits	Other Departments.	Total.	Credits Loan Votes.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Establishment—Salaries	.....	84,375 8 6	.....	2,608 6 11	.....	.....	86,983 15 5	.....
Railway Construction	314,372 5 9	.....	4,120 1 7	.....	273 10 0	.....	318,765 17 4	.....
Tramway Construction	210,505 10 10	.....	559 14 8	.....	3 14 0	.....	211,068 19 6	.....
State Public Buildings	94,024 4 0	34,644 0 11	199,828 2 8	279 1 11	8,149 2 0	.....	336,924 11 6	.....
Roads	.....	64,065 13 11	27,269 14 1	1,418 3 6	.....	.....	92,753 11 6	.....
Bridges	1,690 9 3	18,816 0 10	33,023 6 9	443 10 2	244 16 3	.....	54,218 3 3	.....
Punts and Ferries and Launches	.....	12,611 2 4	3 15 7	.....	109 0 0	.....	12,723 17 11	.....
Public Watering Places, Artesian Bores, Water Conservation, and Water Supplies and Drainage	.....	9,345 13 2	14,922 1 1	.....	47 18 5	.....	24,315 12 8	.....
Harbours and Rivers and Dredge Service	.....	10,638 12 5	.....	.....	2,535 2 3	.....	185,465 9 7	3,043 8 8
	.....	73,553 14 11	98,738 0 0	.....	.....	.....		
Dock Establishment	.....	6,871 11 8	4,596 13 11	.....	.....	.....	11,468 5 7	.....
Water and Drainage Act	29,923 13 6	.....	.....	.....	.....	.....	29,923 13 6	.....
Water Conservation	.....	.....	.....	.....	.....	.....	.....	427 4 8
Barren Jack Reservoir and Northern Murrumbidgee Irrigation Scheme	.....	.....	160,238 10 11	.....	.....	.....	160,238 10 11	.....
Sewerage Construction—								
Metropolitan do	24,647 11 7	1,292 5 6	.....	1 9 8	.....	.....	63,797 15 1	.....
Country Towns do	7,597 8 3	.....	18,920 2 5	.....	.....	.....		.....
Hunter District Water Supply and Sewerage Board	11,338 17 8	.....	.....	.....	.....	.....	.....	.....
Water Supplies—								
Sydney Water Supply	22,253 18 1	.....	.....	.....	776 4 4	.....	126,542 9 1	.....
Country Towns do	13,920 11 7	.....	.....	.....	.....	.....		.....
" Hunter District Water Supply and Sewerage Board	44,805 15 1	.....	44,786 0 0	.....	.....	.....	.....	.....
Labour Bureau	.....	4,759 6 5	.....	7 0 0	4,203 0 6	.....	8,969 6 11	.....
Miscellaneous Schedule	.....	3,965 9 0	.....	.....	.....	.....	3,965 9 0	.....
Compensations and Gratuities	.....	2,798 15 3	.....	102 2 0	.....	.....	2,900 17 3	.....
Equipment, Travelling Allowance, &c.	.....	27,443 7 10	.....	50 17 2	.....	.....	27,494 5 0	.....
Rents, Cleaning, Departmental Contingencies, &c.	.....	10,906 18 1	.....	.....	.....	.....	10,906 18 1	.....
Local Government	.....	179,326 11 8	.....	13,678 1 5	57 12 9	.....	193,062 5 10	.....
Grants to Shires and Municipalities	.....	.....	78,085 13 11	.....	.....	.....	78,085 13 11	.....
Public Pounds	.....	44 10 3	.....	.....	.....	.....	44 10 3	.....
Darling Harbour and "Rocks" Resumption	51,439 11 4	.....	.....	.....	.....	14,012 15 3	65,452 6 7	.....
Gratuities to maintenance men	.....	14,543 16 0	.....	.....	.....	.....	14,543 16 0	.....
Claim against and work done for other Departments	.....	.....	.....	.....	.....	167,016 7 10	167,016 7 10	.....
Claims against and work done for Commonwealth Government	.....	.....	.....	.....	.....	30,159 19 1	30,159 19 1	.....
Total £	826,519 16 11	560,002 18 8	685,091 17 7	18,588 12 9	16,400 0 6	211,189 2 2	2,317,792 8 7	3,470 13 4

	£ s. d.
Expenditure	2,317,792 8 7
Less credits	3,470 13 4
Net expenditure	£2,314,321 15 3

The

The amounts required to complete works in progress on the 30th June were approximately :—

Railway Construction	£3,680,599
Tramway Construction...	345,616
Roads	3,475
Bridges	33,099
Punts	1,825
Harbours and Rivers	178,550
Public Buildings	612,967
Water and Drainage, Artesian Bores, Water Conservation, &c.	1,489,728
Water Supply and Sewerage	371,776
Public Schools	31,381
Total	£6,749,016

The following amounts have been disbursed under supervision of :—

	£	s.	d.	£	s.	d.
Departmental Officers				2,003,363	19	11
Municipalities—						
Roads	33,506	3	0			
Bridges	2,344	12	11			
Harbours and Rivers...	1,663	18	0			
Water Supply and Drainage	1,204	10	8			
Punts and Ferries	170	12	0			
Special Grants...	18,796	0	0			
Repair of Works damaged by Flood...	3,360	0	0			
Miscellaneous	70	0	0			
				61,115	16	7
Shires—						
Endowment	169,865	8	10			
Roads	6,097	12	3			
Bridges	703	16	2			
Punts and Ferries	4,278	5	9			
Harbours and Rivers...	75	8	6			
Water Supply and Drainage	117	13	4			
Special Grants	59,289	13	11			
Repair of Works damaged by Flood...	9,394	0	0			
Miscellaneous	20	0	0			
				249,841	18	9
				£2,314,321	15	3

WORKS AND SERVICES FOR OTHER DEPARTMENTS.

The total expenditure under this heading for 1906-7 was £153,884 4s. 10d., while in 1907-8 it reached £211,189 2s. 2d. This latter amount does not include an expenditure of £16,893 7s. 10d. on account of buildings of the Public Instruction Department, the work in connection with which was supervised by officers of the Government Architect's Branch, but the vouchers were not dealt with by the Public Works Accounts Branch.

CONTRACTS.

The following Comparative Statement of Contracts entered into for the past five years shows that in 1907–8 there was a great decrease in the number of Contracts compared with those of previous years. This was due to the almost entire abolition of Road work by the Department in the Local Government areas of the State. The amount of the Contracts for 1907–8 is, however, large (£1,112,875 7s. 8d.) owing to the very important and extensive Railway, Tramway, Sewerage, and Water Supply works which have been contracted for in the period under review.

COMPARATIVE STATEMENT.

Year.	Number of Contracts let during the year.	Amounts of Contracts let during the year.	Number of Contracts unfinished on 30th June, 1908.	Outstanding Balances on Contracts on 30th June, 1908, due on completion.
		£ s. d.		£ s. d.
1903-4	2,356	350,794 5 7	370	119,870 4 9
1904-5	3,604	586,660 13 3	550	329,013 3 5
1905-6	3,878	578,655 10 5	697	309,627 12 6
1906-7	3,259	627,489 4 5	332	324,561 1 8
1907-8	1,542	1,112,875 7 8	432	667,308 11 4

WAGES.

The number and amounts of Wages vouchers received from officers for the past three years is given below. These are exclusive of the Salaries of officers and also the Dredge Service Wages.

Year.	Number of Vouchers.	Amount.
		£ s. d.
1905–6	7,821	442,568 11 11
1906–7	7,915	306,213 10 7
1907–8	10,420	317,657 12 9

The increased number of vouchers in 1907–8 is mainly due to the introduction of fortnightly payments on many works and services where monthly vouchers were previously rendered.

LAND RESUMPTIONS AND COSTS.

The Disbursements for the year, exclusive of the Darling Harbour and "Rocks" resumptions, were :—

	Loan Votes.	Revenue Votes.	Public Works Fund Votes.	Total Expenditure.	Credits.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Railways	.....	.....	.....	.....	16,086 11 2
Tramways	13,380 0 9	.....	.....	13,380 0 9	.....
Harbours and Rivers	5 14 10	31 3 10	458 19 4	495 18 0	.....
Sewerage Construction	589 18 6	.....	.....	589 18 6	.....
Water Supplies	94 19 8	.....	30 1 5	125 1 1	.....
Public Watering Places	.....	32 7 1	300 0 0	332 7 1	.....
Water and Drainage	12 2 0	.....	.....	12 2 0	.....
Public Buildings	76,268 14 11	5 15 6	238 8 8	76,512 19 1	.....
Roads	.....	127 7 6	.....	127 7 6	.....
Bridges	.....	.....	166 13 4	166 13 4	.....
Barren Jack Dam	.....	.....	526 10 0	526 10 0	.....
	90,351 10 8	196 13 11	1,720 12 9	92,268 17 4	16,086 11 2

BANK ACCOUNTS.

The number of Bank Accounts of the Department dealing with expenditure was as follows :—

No. of Accounts on 1st July, 1907.	No. of New Accounts opened, 1907–8.	No. of Accounts closed, 1907–8.	No. of Accounts open on 30th June, 1908.
74	23	15	82

Advances granted to enable wages and other urgent claims to be promptly paid, were as follows :—

Account.	Amount of Advance.	Amount unadjusted on 30th June, 1908.
	£	£ s. d.
Floating Advances	63,487	16,618 19 8
Overdraft Accounts, Expenditure Suspense and Salaries Suspense	16,000	6,094 13 6
£	79,487	22,713 13 2

The operations through the various Expenditure Bank Accounts were :—

Receipts.	Disbursements.	Dr. Balance.	Cr. Balance.	Net Dr. Balance.
£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
736,446 18 7	738,675 3 8	6,088 3 6	3,859 18 5	2,228 5 1

The operations through the Head Office Bank Accounts for the receipt of revenue, deposits, and for other purposes, were :—

Account.	Receipts.	Disbursements.	Balance.
	£ s. d.	£ s. d.	£ s. d.
Suspense	80,563 13 10	80,558 8 10	5 5 0
Trust	35,763 3 2	35,763 3 2	.....
	£116,326 17 0	116,321 12 0	5 5 0

The Trust Account was made up of 2,094 items lodged as preliminary or security deposits by cash in connection with tenders or contracts.

FIXED

FIXED BANK DEPOSIT RECEIPTS.

STATEMENT of Receipts and Disbursements from 1st July, 1907, to 30th June, 1908.

Of amounts held as securities for contracts.

Receipt.	No.	Amount.	Disbursements.	No.	Amount.
		£ s. d.			£ s. d.
Balance at 30th June, 1907	63	34,150 0 0	Returned to Contractors	55	20,407 0 0
Receipts 1st July, 1907, to 30th June, 1908	89	34,742 0 0	Renewed for Contractors	1	175 0 0
			Balance held by the Paymaster, 30th June, 1908	96	48,310 0 0
	152	£68,892 0 0		152	£68,892 0 0

TOTAL OPERATIONS BY PAYMASTER.

The amounts dealt with in the Accounts Branch by the Paymaster, as given above, make up the following grand total :—

Account.	Receipts.	Disbursements.	Dr. Balance.	Cr. Balance.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Expenditure accounts	736,446 18 7	738,675 3 8	2,228 5 1	.....
Revenue deposits and other moneys	116,326 17 0	116,321 12 0	.....	5 5 0
Fixed bank deposits, Securities on Contracts	68,892 0 0	20,582 0 0	.....	48,310 0 0
Total £	921,665 15 7	875,578 15 8	2,228 5 1	48,315 5 0

The amount disbursed by the Paymaster during the year out of the total of £2,314,321 15s. 3d. was £738,675 3s. 8d., and the balance of £1,575,646 11s. 7d. was paid by the Treasury direct or dealt with by transfer.

WATER AND DRAINAGE TRUSTS.

Particulars of these trusts are given in an Annexure as to name, date of gazettal, gazetted cost annual payment, &c.

COUNTRY TOWNS WATER SUPPLY AND SEWERAGE.

Financial investigations have been made in connection with the following proposals :—

New Works.

Gunnedah Water Supply.
Bowral ,,
Murwillumbah ,,
Gundagai ,,
Mittagong Water Supply.
Kempsey ,,
Goulburn Sewerage.
Camden ,,

Extensions of Existing Works.

Dubbo Water Supply.
Wellington ,,
Nowra ,,
Wollongong ,,
Casino Water Supply.
Picton ,,
Ballina ,,
Lismore ,,

The books in connection with the Water Supply at Goulburn and the Water Supply and Sewerage at Hay, have also been examined and reports furnished in regard thereto.

The Water Supply at Tamworth is still being administered by the Department, and the usual audit and examination of the books has been regularly carried out.

An Annexure sets forth further particulars relating to Country Towns Water Supplies, their capital debts, &c.

OFFICERS.

In the Statements with reference to the cost of supervision only the Chief Engineers, Dredge Service, are taken into account, as the other Dredge Service employees, both permanent and temporary, are deemed not to be "Officers" in the ordinary acceptance of the term ; also for the same reason the following have been omitted :—Mechanics, maintenance men, labourers, Labour Farm hands, and others employed without the specific authority of the Public Service Board.

The Staff of the Department at end of financial years 1906–7 and 1907–8 was as follows :—

Branch.	No. of Officers.		Annual Salary Charge.	
	30th June, 1907.	30th June, 1908.	30th June, 1907.	30th June, 1908.
			£	£
Permanent	439	395	113,175	102,875
Temporary	236	346	39,626	59,656
Dredge Service employees, not engaged in supervision — Permanent	297	287	41,904	40,950
Dredge Service employees, not engaged in supervision — Temporary	46	71	5,460	8,652
Total	343	358	47,364	49,602

The Permanent Staff shows a decrease—44 Officers and £10,300 in salaries, due in a great measure to expiration of leave and subsequent retirement of officers joining Shire Councils.

The Temporary list is much larger than at 30th June, 1907, an increase of Officers, 110, and in salaries, £20,030, mainly attributable to the great number of works in hand and proposed.

The actual disbursement for salaries and wages of Officers, from Loans and Revenue Votes, or other headings of appropriation, during the financial year 1907–8, are as follows :—

Permanent Staff.

	£	s.	d.	
General Staff ...	102,215	17	4	
Dock	2,810	11	3	
Labour Bureau	717	13	6	
Dredge Service	44,463	15	2	
				£150,207 17 3

Temporary Officers.

	£	s.	d.	
General Staff ...	50,674	0	3	
Labour Bureau	1,146	19	6	
Dredge Service	5,994	16	3	
				£57,815 16 0

The disbursements in connection with administration, design, and supervision may be stated as :—

	£	s.	d.	£	s.	d.
Salaries—						
Permanent ...	150,207	17	3			
Temporary ...	57,815	16	0			
				208,023	13	3
Allowances, &c.—						
Equipment ...	8,680	8	2			
Other allowances, travelling expenses, hire of vehicles, and sundries ...	14,555	18	4			
Rents ...	601	19	9			
Cleaning, fuel and light, country offices	124	8	6			
Fuel and light, Head office ...	162	0	10			
Postage and telegrams	2,928	1	6			
Telephones	280	14	4			
				27,333	11	5
Total disbursements				£235,357	4	8

Of the above, the charges for those who would be employed by Contractors, such as foremen, gangers, overseers, leading hands, time and store keepers, mechanics, labourers, &c., are estimated at £72,720 5s. 3d.

	£	s.	d.
Total disbursements ...	£235,357	4	8
Less ...	72,720	5	3
	£162,636	19	5

The total expenditure for the year was £2,314,321 15s. 3d. The sum of £162,636 19s. 5d. represents 7 per cent. of the expenditure.

In further reference to the salaries and allowances of Permanent and Temporary Officers, I append statements as follows :—

5. Return of Officers, with Annual Salaries and Allowance Charges, as at the 30th June each year.
6. Statement of the number of Officers actually engaged on the 30th June of each year, with amount of disbursements for Salaries, Equipment, and Travelling Allowances throughout the year.

In conclusion I would add that the work in the Accounts Branch throughout the year has been heavy, and has necessitated the best energies of the officers being put forth. I am pleased to say that the staff has most willingly and satisfactorily responded to the demand, and carried out the duties required most efficiently.

THOMAS R. STEEL,
Accountant.

11th September, 1908.

WATER AND DRAINAGE.

THE undermentioned Trusts have been formed in connection with the Bores, &c., constructed under the Water and Drainage Act, and the debts have been fixed and gazetted.

Name of Bore, &c.	Date Gazetted.	Gazetted Cost.	Total Annual Payment.	Amount of first Payment.	Due date.	Subsequent Payments.	How Payable.
		£ s. d.	£ s. d.	£ s. d.		£ s. d.	
Florida	30 Nov., 1905	2,984 3 9	179 1 0	70 5 0	31 May, 1906	89 10 6	Half-yearly.
Three Corners	30 Dec., 1905	1,530 4 4	91 16 4	43 15 4	30 June, 1906	45 18 2	„
Old Gnomery	8 Jan., 1906	4,132 10 0	246 0 8	184 10 6	8 July, 1906	61 10 2	Quarterly.
Come-by-Chance	18 Feb., 1906	4,049 16 10	243 15 0	86 8 4	18 Aug., 1906	115 19 3	Half-yearly.
Mercadool	12 Sept., 1906	2,453 1 8	146 1 0	109 10 8	12 Mar., 1907	36 10 3	Quarterly.
Kiga	26 „ 1906	5,638 3 1	336 17 4	252 12 11	26 „ 1907	84 4 4	„
Euraba	9 Oct., 1906	863 5 9	324 14 0	243 10 6	9 April, 1907	81 3 6	„
Ulumbie	17 „ 1906	3,140 7 6	186 19 4	140 4 6	17 „ 1907	26 14 10	„
Big Swamp Drainage	24 „ 1906	7,797 12 8	469 9 2	87 19 3	1 Jan., 1907	234 14 7	Half-yearly; payments deferred for three years.
Lyndhurst	30 „ 1906	233 19 11	13 8 8	10 9 0	30 April, 1907	3 9 8	Quarterly.
Nelson's Plains Drainage	5 Dec., 1906	150 0 5	18 6 7	13 14 11	5 June, 1907	4 11 8	„
Uranbah	16 Jan., 1907	928 19 10	205 6 2	153 19 7	16 July, 1907	51 6 6½	„
Eurie Eurie	7 Feb., 1907	5,110 16 8	305 10 4	166 11 4	7 Aug., 1907	146 13 10	Half-yearly.
Walgett	20 Mar., 1907	2,409 0 9	219 8 6	164 11 9	20 Sept., 1907	54 17 1	Quarterly.
Terranora Swamp Drainage	29 „ 1907	179 7 7	10 13 7	8 0 2	29 Nov., 1907	2 13 5	„
Neargo	23 May, 1907	3,812 0 0	226 19 0	170 4 3	23 „ 1907	56 14 9	„
Boomi	2 Oct., 1907	1,120 3 2	339 13 8	254 15 4	2 April, 1908	84 18 5	„
Youendah	16 „ 1907	759 9 5	189 4 4	141 18 3	16 „ 1908	47 6 1	„
Bourbah	23 „ 1907	1,194 7 6	183 1 9	137 6 9	23 „ 1908	45 15 7	„
Oreel No. 2	27 Nov., 1907	5,657 17 5	336 16 11	252 12 8	27 May, 1908	84 4 3	„
Tulloona	16 Jan., 1908	1,283 9 0	296 8 2	222 6 1	16 July, 1908	74 2 1	„
Careunga	5 Feb., 1908	6,180 0 10	367 18 8	275 19 0	5 Aug., 1908	91 19 8	„
Moomin	12 „ 1908	823 6 4	198 0 4	148 10 3	12 „ 1908	49 10 1	„
	£	62,432 4 5					

COUNTRY TOWNS WATER SUPPLIES.

STATEMENT of gazetted works.

Municipality.	Debt as gazetted.		Period of Repayment of Debt.	Annual Repayment Instalment.
	Amount.	Date.		
	£ s. d.			£ s. d.
Albury	41,000 0 0	31 Dec., 1894	100 years	1,482 11 0
Wagga Wagga	38,500 0 0	31 „ 1894	100 „	1,392 3 0
Goulburn	55,0 0 0 0	31 „ 1894	100 „	1,988 16 0
Bathurst	55,000 0 0	31 „ 1894	100 „	1,988 16 0
Orange	32,688 0 0	31 „ 1894	100 „	1,182 0 0
Bourke	13,436 0 0	31 „ 1894	100 „	485 17 0
Deniliquin	18,468 7 2	31 „ 1894	100 „	667 16 0
Wentworth	4,000 0 0	31 „ 1894	100 „	144 13 0
Balranald	6,000 0 0	31 „ 1894	100 „	216 19 0
Lismore	10,016 4 8	31 „ 1894	100 „	362 3 6
Hay	7,691 4 10	31 „ 1893	100 „	278 2 2
Wilcannia	8,380 12 4	31 „ 1894	100 „	303 1 2
Forbes	7,958 7 2	31 „ 1893	100 „	287 15 3
Cootamundra	10,896 0 0	31 „ 1894	100 „	394 0 0
Jerilderie	5,428 14 5	31 „ 1894	100 „	196 6 3
Lithgow	12,749 5 11	30 June, 1896	100 „	461 0 0
Dubbo	15,238 3 4	30 „ 1896	100 „	551 0 0
Nowra	12,592 15 10	30 „ 1896	100 „	455 7 3
Nyngan	9,000 0 0	31 Dec., 1896	100 „	325 8 9
Moama	7,600 11 0	25 Feb., 1898	100 „	274 16 4
Moss Vale	13,000 0 0	1 July, 1898	100 „	470 0 0
Coonamble	6,742 8 1	1 „ 1898	100 „	243 15 10
Armidale	40,417 13 2	1 „ 1898	100 „	1,461 10 3
Warren	3,969 3 4	21 Aug., 1900	100 „	143 10 5
Picton	15,951 1 10	15 Feb., 1901	100 „	576 15 10
Kiama	7,073 9 8	19 Mar., 1901	109 „	255 15 3
Condobolin	7,039 5 8	16 Apl., 1901	100 „	254 10 9
Berry	4,323 0 0	13 May, 1902	100 „	156 6 4
Wellington	12,061 10 10	26 Apl., 1902	100 „	436 2 10
Mudgee	17,029 13 11	3 Feb., 1903	100 „	615 15 10
Junee	42,000 0 0	14 July, 1903	100 „	1,518 14 5
Cobar	26,067 11 0	29 Dec., 1903	100 „	942 12 0
Tumut	10,238 0 10	26 Aug., 1903	100 „	370 4 2
Blayney	10,519 15 9	19 Oct., 1904	100 „	380 7 11
Ballina	13,605 0 0	30 Dec., 1904	100 „	491 19 1
Moree	10,940 10 0	2 „ 1904	100 „	395 12 2
Casino	10,285 4 5	12 Sept., 1906	100 „	371 18 3
Hillgrove	4,000 0 0	7 Nov., 1906	100 „	170 10 9
Parkes	13,660 8 0	27 Apl., 1894	100 „	493 19 2
Corowa	9,317 17 4	5 Feb., 1908	100 „	397 5 2

Annexure.

RETURN of Officers with Annual Salaries and Allowances charged as at 30th June of each financial year as under:—

Financial Year.	Permanent.			Temporary.			Totals.		
	No.	Annual Charge.		No.	Annual Charge.		No.	Annual Charge.	
		Salary.	Allowance.		Salary.	Allowance.		Salary.	Allowance.
		£	£		£	£		£	£
1899–1900	972	193,635	10,900	272	48,126	167	1,244	241,761	11,067
1900–1901	976	200,145	12,655	412	70,959	1,722	1,388	271,104	14,377
1901–1902	1,010	204,536	12,858	497	84,597	2,083	1,507	289,133	14,941
1902–1903	1,015	206,986	13,011	347	61,731	1,541	1,372	268,717	14,552
1903–1904	853	176,796	11,827	107	17,316	551	960	194,112	12,378
1904–1905	784	161,569	12,690	109	16,936	21	893	178,505	12,711
1905–1906	782	161,292	11,641	156	22,801	100	938	184,093	11,742
1906–1907	738	155,880	6,822	282	45,086	1,153	1,020	200,966	7,975
1907–1908	682	143,825	7,043	417	68,308	1,546	1,099	212,133	8,589

Annexure.

STATEMENT showing number of Officers, Permanent and Temporary, actually engaged on the 30th June of Financial Years 1899–1900 to 1907–8, with amount of Disbursements for Salary, Equipment, and Travelling Allowances during those years (Officers on leave prior to retirement, or lent to other Departments, not included).

Year.	Permanent.				Temporary.				Total.			
	No.	Salaries.	Equipment.	Travelling.	No.	Salaries.	Equipment.	Travelling.	No.	Salaries.	Equipment.	Travelling.
		£ s. d.	£ s. d.	£ s. d.		£ s. d.	£ s. d.	£ s. d.		£ s. d.	£ s. d.	£ s. d.
1899–1900	972	192,943 7 2	14,315 17 6	9,746 4 4	272	47,863 8 4	166 19 11	1,702 6 5	1,244	240,806 15 6	14,482 17 5	11,448 10 9
1900–1901	976	205,738 12 9	15,510 3 0	10,584 2 5	412	61,992 8 5	1,722 1 5	2,013 0 10	1,388	267,731 1 2	17,232 4 5	12,597 3 3
1901–1902	1,010	203,271 2 2	16,534 3 0	11,123 1 7	497	83,078 10 1	2,083 16 5	1,642 7 8	1,507	286,349 12 3	18,617 19 5	12,765 9 3
1902–1903	1,025	207,395 3 6	16,923 19 6	11,020 3 6	347	82,076 14 7	1,541 17 5	1,717 6 5	1,372	289,471 18 1	18,465 16 11	12,746 9 11
1903–1904	739	179,813 13 11	14,722 3 2	9,324 9 7	107	42,997 10 7	551 5 5	271 15 6	846	222,811 4 6	15,273 8 7	9,596 5 1
1904–1905	741	158,504 19 5	12,601 12 4	7,256 7 4	109	16,685 17 11	21 3 4	242 3 2	850	175,190 17 4	12,622 15 8	7,498 10 6
1905–1906	757	154,752 19 8	13,147 19 7	7,920 17 10	171	21,793 0 5	28 11 4	607 7 10	928	176,546 0 1	13,176 10 11	8,528 5 8
1906–1907	694	146,359 8 3	6,388 5 2	6,350 10 2	282	34,485 11 0	320 14 9	604 17 5	976	180,844 19 3	6,708 19 11	6,955 7 7
1907–1908	682	146,847 4 11	7,524 3 10	6,665 9 6	417	57,815 16 0	1,077 1 0	1,158 2 8	1,099	204,663 0 11	8,601 4 10	7,823 12 2

Rivers

Rivers, Water Supply, and Drainage Branch.

Report of the Acting Chief Engineer for Rivers, Water Supply, and Drainage.

Sir, 29 October, 1908.

I have the honor to submit herewith a report covering the operations of the above Branch of the Public Works Department for the year ending the 30th June, 1908. I regret that the absence of Mr. L. A. B. Wade, Chief Engineer, in England, prevents him submitting this report himself. The strain thrown upon the Head of the Branch by the extension of its operations during the past few years has necessitated Mr. Wade taking leave for recuperative purposes since April last.

Some changes have taken place in the staff during the year under review. Mr. Millner, previously District Engineer at Newcastle, having, on the 24th March, been appointed President of the Metropolitan Water Supply and Sewerage Board, Sydney, his place was filled by the appointment of Mr. Percy Allan, formerly attached to Head Office, as District Engineer at Newcastle; and, following on these changes, a re-arrangement was made of the duties of some the the Officers, with the result that the sub-branches are now under the charge of Assistant Engineers as follows:—

Harbours and Rivers—Mr. W. Rossbach.
Country Towns Water Supply—Mr. T. E. Burrows.
Artesian Boring, Swamp Drainage, and minor Water Conservation Works—Mr. S. H. Weedon.
Sewerage Construction—Mr A. Peake.
Irrigation—Mr. W. Claude Wilson.

while the work of river gauging has been entrusted to Mr. Surveyor H. Shute.

Close attention has been given to the organisation of these services under the above heads, and I have pleasure in stating that the system is working satisfactorily.

The following report shows that the year under review has been one of great activity, and I am glad to be able to draw the attention of the Hon. the Minister to the rapid and satisfactory progress made with the Northern Murrumbidgee Irrigation Scheme.

It was hoped that a Bill to give effect to the agreement arrived at between the Premiers of New South Wales, Victoria, and South Australia in 1907, with regard to the control and regulation of the Murray River waters, would have become law prior to the issue of this report, but unfortunately the measure has been delayed. Works of great importance to the State await a final agreement upon this subject, and it now seems probable, before the issue of the next Annual Report of this Department, a settlement will have been arrived at.

I have to acknowledge the cordial co-operation of all the Officers connected with the Branch, which has greatly assisted me in dealing with the work during Mr. Wade's absence.

E. M. DE BURGH,
Acting Chief Engineer.

The Under Secretary.

CATARACT DAM.

In the report for the year ending 30th June, 1907, full particulars were given of the Cataract Dam, Sydney Water Supply, and it was pointed out that the completion of the whole of the work might be looked for in January, 1908. The work was finally completed and handed over to the Metropolitan Board of Water Supply and Sewerage on the 10th June, 1908. The main work was really finished at a much earlier period, but some time was occupied with the completion of details, such as the Valve House, roads of access, etc., and, as pointed out in the previous report, the Dam was used for the purposes of storage at a much earlier date. Although no very heavy coastal rains have since occurred, the storage has already been found of great benefit in connection with the supply to the city, and on the 30th June, 1908, the water stood at a depth of 106·67 ft. behind the Dam, equal to a contents of 4,371,000,000 gallons.

NORTHERN MURRUMBIDGEE IRRIGATION SCHEME.

Barren Jack Dam.

Steady progress has been made in connection with the construction of this work during the past year. A Diversion Channel, capable of carrying, approximately, 8,000 cusecs, has been excavated through the solid rock on the right-hand bank of the river, and concrete Diversion Dams have been constructed across the river channel, both up-stream and down-stream of the Dam site, with the result that the ordinary flow of the river is entirely diverted from the river bed, where operations can be carried on free from interruption in times of considerable flood. The construction of these works was both costly and difficult, the river-bed being covered with huge boulders, and the flow of the river, although its condition was favourable to the operations, being quite sufficient to render the carrying out of excavations in the river-bed both difficult and slow.

As any flood exceeding 8,000 cubic feet a second will top these works, arrangements have been made for drawing off so much of the water as can be removed by gravitation on the subsidence of the flood, and for powerful pumps to deal with the remainder of the water.

Platforms for the Lidgerwood Cable-ways have been excavated on each side of the river, and one of the cable-ways is already in place. These machines have a span of 1,200 feet, and are capable of lifting 10 tons at the rate of 200 feet a minute, and traversing at the rate of 1,000 feet a minute. The erection of the Power House has been completed, and three electric units of 100 horse-power each placed, while the foundations have been put in for a further unit of 200 horse-power. The completion of the works at the site

site of the Dam to this stage has enabled us to expose the foundation for the structure from side to side of the river, and it is now found that anticipations as to the class of foundation obtainable have not only been realised but exceeded. The foundation is of solid, red granite, water-worn into a most regular surface, highly suitable for a foundation of the class, even without benching, and disclosing no fissures or seams beyond the tight joints characteristic of stone of this class. It is impossible that any foundation for such a structure superior to that now disclosed at the works could be obtained. Regarding the quality of the materials available for the construction of the Dam itself, numerous tests have been made of granite and sand obtained from the site also of mortar and concrete made from these materials. The properties determined being weight, percentage of voids, compressive and tensile strengths. These tests show that most satisfactory results can be obtained from the use of the local stone and sand. The specific gravity of the granite is 2·596, and the weight per cubic foot, 162·05 lb.

With regard to the local supervision of this great work, Mr. W. A. Smith remained in charge up to March, 1908, when he returned to his previous post in the Metropolitan district, and the work of supervision was entrusted to Mr. F. M. Smith, who was previously engaged in the location of the site and preliminary operations.

Goondah-Barren Jack Railway.

As pointed out in the previous report, the key to the situation at Barren Jack is the construction of railway communication between the site of the dam and the main Southern railway. The 2 ft. gauge line from Goondah to Barren Jack was completed through to the site in the first week of June, 1908.

The length of Permanent Way is 28 miles, and total Cost of Line, £57,685

Its rapid completion has enabled the works at the Barren Jack Dam to be pushed forward during a season favourable for the diversion of the river, and it is difficult to estimate the saving which has been effected by bringing forward the construction of the dam by a year or so, as compared with what would have been the cost had the construction of the line been delayed.

Apart from its usefulness in connection with the Barren Jack Dam, the construction of this railway has aroused considerable interest in the State, being regarded as an object lesson in the construction of narrow-gauge lines, with sharp curves, in difficult country. In the case of the Barren Jack Railway, it would be impracticable to reach the site of the dam with a curvature such as is adopted on the standard main lines.

The survey, location and construction of this railway were carried out by Mr. C. R. Cuningham.

CANALS AND DIVERSION WORKS.

During the last twelve months the work of constructing the main canals and diversion works in the vicinity of Narrandera has been pushed on very rapidly. In the case of the Diversion Weir and Canal Head Gates at Berembed, some 20 miles above the town of Narrandera, although a start was made only in December, 1907, at the present time some 10,000 cubic yards of rock excavation, or about two-thirds of the total quantity necessary has been completed; the larger, or right-hand concrete abutment wall is well on towards completion, and nearly the whole of the plant and machinery required for the completion of this part of the work has been erected and is in full working order. A coffer dam has been constructed, thus allowing work to be continued during moderate rises in the river, when it would otherwise have been interfered with; and with the river rising no higher than it has, so far done, since the start of the work, these diversion works should by the end of next summer be nearing completion.

A township, similar to that described in the last Annual Report as existing at Barren Jack, has been laid out, and so far the whole of this work has been carried out by day labor.

The work of excavating the main canal, which, with a bed width of 50 ft., side slopes of 1½ to 1, and 7 ft. flow depth, will carry 1,000 cusecs, has been steadily progressing during the past twelve months, and is, together with protecting flood banks, completed to full size for a short distance above, through, and below Narrandera, in all about 5 miles. A further section about 5½ miles above Narrandera is under construction and nearly finished, while the largest of the flood banks between that point and the town has been constructed.

The Narrandera Regulator, a fine concrete structure, having five quadrant gates each 12 ft. in width, and also carrying a highway bridge, has been completed, as have five highway bridges, two smaller bridges carrying the water and sewerage mains of the town of Narrandera, a reinforced concrete syphon 6 ft. internal diameter to carry the stormwater drainage of that town under the canal, and a large length of netting boundary fences to protect the canal banks from rabbits and stock.

The first Experimental Irrigation Farm, having an area of 300 acres, and situated on the canal line about 14 miles west of Narrandera, and alongside the Yanco siding on the South Western Railway Line, has been resumed, cleared, fenced and ploughed, and is now under the control of the Agricultural Department, who are planting out the various fruits and crops deemed suitable for the locality.

In addition to the works actually completed contracts have been let for the construction of another Regulator at Bundidgerry, about 5½ miles above Narrandera, similar in design to the Narrandera Regulator, and which will, with that one and the head gates at Berembed, effectually control all waters entering the canal, and also for a further section of canal for a distance of 6 miles beyond that already constructed below Narrandera, which section is now under construction. Arrangements have also been made for the erection of a telephone line between Berembed and Narrandera, and contracts have been let for numerous lengths of fencing along the line of canal.

A further length of 15 miles of canal is being advertised for contract, while a still further length of 20 miles as far as the Mirrool Creek is ready for putting in hand.

The trial survey lines for branch canals have also been proceeded with during the year, and with the passing of the necessary legislation the work of re-subdivision of the resumed land will be at once entered upon.

As the permanent survey staff of the Department has been so fully occupied on other necessary work, the survey of land required for canal construction during the past twelve months has had to be carried out by contract. The local office staff at Narrandera has been employed in preparing plans for contracts,

progress plans and measurements for works in hand and supervising the construction generally, which supervision, owing to the large amount of day labor required owing to unsatisfactory contract prices offering in the early part of the year, involved a considerable amount of work which would otherwise have been unnecessary.

So far, about 700,000 cubic yards of canal excavation have been finished, and the total cost to date of canal, diversion weir, head gates, regulators, bridges, syphons and all other works, surveys, design, and supervision has been about £68,000.

This portion of the work has been carried out under the direction of Mr. W. Claude Wilson, Mr. G. W. Mitchell being Resident Engineer.

WATER SUPPLY FOR THE COUNTY OF CUMBERLAND.

The great increase in population in the County of Cumberland, and the rapid growth of the City of Sydney during recent years, has directed attention to the necessity for consideration of the future sources of water supply for a large population. The completion of the Cataract Dam upon the existing catchment of the Sydney Water Supply has made provision for the immediate needs of the City and Suburbs. Storage sites for additional Reservoirs to meet the growing needs of population have already been surveyed, and instructions have been issued by the Hon. the Minister for the preliminary arrangements to be made in anticipation of placing the work of construction of another large Storage Reservoir (probably upon the Cordeaux) in hand as soon as the requirements warrant it. The supply available from the Catchment Area reserved in connection with the Sydney Water Supply will not be sufficient in the future to meet the large requirements of the County of Cumberland, and an influential deputation waited upon the Minister for Works at Penrith on the 13th June to urge the construction of some scheme for the supply of large volumes of water for irrigation and manufacturing purposes to the Country of Cumberland. An investigation was accordingly made of a scheme to utilise the enormous volume of water available from the catchment of the Nepean and Warragamba Rivers above Penrith, which showed that, from a catchment of no less than 3,383 square miles, an enormous supply of water could be delivered to the Central Cumberland Districts at a point some few miles above Penrith. The preliminary report which was presented to the Minister is published as an appendix. The necessary surveys and information to enable the scheme to be worked out are now being obtained.

MACQUARIE RIVER.

A thorough exploration of the upper portion of this river for sites for storage purposes has been made.

Four sites were investigated, that at the junction of the Macquarie and Cudgegong Rivers is, as far as reports to hand show, the best obtainable.

It is estimated if a dam 160 ft. high were constructed immediately below the junction of the above-mentioned rivers, it would store approximately 20,000 million cubic feet of water. The water impounded in this dam, after passing down the river to a few miles above the town of Narromine, could, by means of a high diversion weir erected at this point, be diverted into a main canal, and distributed over the land to be irrigated.

This site commands the greater portion of the country from Narromine to Nyngan, which is chiefly of a red loamy soil, very suitable for irrigation. Sufficient information is not yet available to give a close estimate of the cost of a dam at the site referred to, but from the data to hand it would appear that a practicable irrigation scheme can be evolved.

LACHLAN RIVER.

Lake Cudgellico.

The work of raising dams "A" and "C" is now completed, and will materially strengthen the dams against the action of waves caused by high water on the lake.

The surplus water of the rise which came down in August was impounded to height of R.L. 517 on the lake gauge, equal to an available depth of 8 ft. of water.

In January the stored water was released, and provided a steady flow down the lower Lachlan for four months, and, with the aid of the weirs, water was thus available for the greater part of the year, as against a couple of months during the year under natural conditions.

In order to estimate the cost of further increasing the storage capacity of these works, surveys will be put in hand.

Hunthawong Weir.

The renewal of this work has not been put in hand pending the investigation of the Wyangala proposal by the Public Works Committee.

Bumbuggin Creek.

The snagging of the river below Bumbuggin Creek has been completed.

Surveys for the proposed regulator and channel to control the flow into this creek from the river will shortly be put in hand.

Willandra Weir and Regulator.—Booligal Weir and Booberoi Weir.

These works have been maintained in good order and constant use in maintaining the flow of the river during the year.

Wyangala Reservoir.

The investigations for the cost of dam, capacity, available run-off, and discharge diagrams for this scheme have been completed during the year, and will shortly be put before the Public Works Committee, as soon as further investigations relating to the use of the water further down the river, the location of a railway leading to the dam site, and other details necessary to arrive at the total cost and effect of the whole scheme are completed.

COUNTRY TOWNS WATER SUPPLY.

Works Completed.

Katoomba.—The supply and erection of the pumping machinery and boiler has been completed The first contract let for the work was unsatisfactory, and had to be cancelled. A temporary plant was then installed, and worked satisfactorily until the installation of the permanent plant, which was completed and tested during June, and found equal to the duty specified in contract. A high-pressure Babcock and Wilcox boiler was supplied with the plant, with a working pressure of 160 lb. to the square inch, and heating surface of 593 square feet.

The pump supplied has 9 in. and 16 in. cylinders, 7 in. plunger, and 12 in. stroke horizontal duplex outside-packed ram pump, with surface condenser, single cylinder vacuum pump, and Gardner duplex feed pumps, feed water heater, and other accessories.

The specified duty for the test was the pumping of 18,000 gallons per hour to an elevation of 397 ft., through 8,265 ft. of rising main of 8 in. diameter over a continuous period of eight hours.

Extra reticulation pipes have also been laid by the Municipal Council.

Lithgow.—The additional service main was put into use, and the construction of the new dam across Farmer's Creek was completed. This dam is 84 ft. high, and curved in plan to a radius of 100 ft., and will impound 88,000,000 gallons of water.

Warren.—The supply of an elevated tank, holding 20,000 gallons, and raised to a height of 50 ft., has been completed. Pumping machinery worked by an oil engine has also been installed to raise water from the artesian bore to the tank referred to. These works have been made necessary owing to the natural pressure from the bore having become too low to give a good service.

Medlow.—A concrete dam, 65 ft. in height, and curved in plan to a radius of 60 ft., has been constructed across Wall's Creek, near Medlow Bath. The water which will be impounded will amount to 67,000,000 gallons, and may be used for the supply of Blackheath and adjacent villages. The Site for this Dam was a most economical one and led to the adoption of a width of base of 9 ft., which, considering the height of Dam, shows the most economical cross section at which a curved Dam has been constructed in the State.

The limit of pressure allowed for in this case is 12 tons per square foot.

Waterfall Benevolent Institution.—The works for supplying water to this institution were completed. The water is raised from Waterfall Creek at the rate of 4,200 gallons per hour by a pump worked by an oil engine. The water is pumped through a 4 in. rising main, 53 chains long, to a Monier reservoir, 29 ft. 9 in. diameter, and 15 ft. 8 in. deep, holding 50,000 gallons, the total lift being 530 ft.

The reservoir is elevated on a ferro-concrete support, 24 ft. above ground level. A 6 in. service main, 25 chains long, conveys the water to the institution.

Morisset Asylum.—The works for supplying the new Hospital for Insane with water have been completed. A dam was constructed across Duckhole Creek, and the water pumped through a 6 in. main, 70 chains long, to a small service reservoir on a hill commanding the buildings, and conveyed by 6 in. service pipes to the hospital.

Ballina.—The construction of a concrete Service Reservoir on a commanding site at East Ballina was completed, and an extension thereto of the main pipe-line has also been carried out. The capacity of the reservoir, which is 65 ft. in diameter and 16 ft. deep, is 300,000 gallons, and the length of the extra 6 in. main pipes laid to it is 6,666 ft.

Jerilderie.—An addition to these works has been carried out by the Municipal Council in providing a windmill pump to assist in the economical working of the plant by taking advantage of the wind-power, when available.

Port Kembla.—The pipe lines from the Wollongong gravitation mains have been laid to the villages of Figtree, Unanderra, and Port Kembla. A service reservoir of Monier concrete has been erected on the hill south of the Port, and about 5 miles of service pipes have been laid from the Wollongong reservoir to the villages of Unanderra and Figtree, and 6¼ miles of high-pressure mains to Port Kembla service reservoir, and from thence reticulation mains have been laid for distances totalling 5,210 ft. of 9 in. and 1,250 ft. of 6 in. cast-iron pipes for the convenience of the various manufacturing and shipping companies.

Casino.—Additions to the pumping machinery and reticulation pipes have been carried out during the year. The new pump is a Worthington direct-acting 12 in. x 8 in. x 18 in. deep well pump, and fitted up by the Council's engineer as an auxiliary to the centrifugal pump previously supplied.

Tamworth.—A small silt dam has been constructed at Moore Creek.

Illewong.—A tank supply, comprising 12,000 cubic yards of excavation and embankment across a valley, has been completed, and now contains 18 ft. of water, 12 ft. excavation, and 6 ft. over the original ground surface.

Works Under Construction.

Cowra.—This town is being supplied by pumping naturally-filtered water from the drift near the left bank of the Lachlan River. A well, 15 ft. in diameter, has been sunk 56 ft. deep, and 260 ft. back from the Lachlan River, and a machinery shaft, 49 ft. deep and 10 ft. in diameter has also been sunk, and a tunnel, 230 ft. long, is now being driven to connect these shafts.

A service reservoir, holding 300,000 gallons, has been constructed on Park Hill, 264 ft. above pump-well, and above the town. The rising main and service pipes, of a total length of over 8 miles, are laid throughout the portions of the township intended to be served.

A contract has also been let for the supply of steam pumping plant, and most of this is now on the ground waiting to be put in place when the engine-house has been made ready for it.

Corowa.—Extra lengths of reticulation pipe are being laid by the Municipal Council, and it is proposed to sink a cylinder inside the pump-well to enable the lowest 3 ft. of the drift to be drawn upon.

Ballina.—A contract is now in hand for the construction of a road to East Ballina reservoir, and this will shortly be completed.

Gunnedah.—The first contract for the water supply works here is nearly completed, and comprises a brick well sunk in the drift, on the flat adjoining the right bank of the Namoi River, and a rising main pipe-line to the commanding hill above the railway, where a Monier service reservoir, 41 ft. in diameter, and 40 ft. high, holding 314,000 gallons, has been completed.

The service mains throughout the streets of the town are now nearly all laid. The contract for the machinery for pumping is also well in hand. Most of the material is now on the site, and the work of seating the pumps is being commenced.

Gundagai.—This supply is being obtained from the drift on the flat near the right bank of the Murrumbidgee River. A pump-well is being sunk in the drift, and the water will be forced through 68 chains of 6-inch rising main to the concrete service reservoir of 200,000 gallons capacity on Mount Parnassus, a suitable site, commanding the township. The reticulation mains, consisting of $3\frac{1}{2}$ miles of 4-in. and 3-in. pipes, have also been nearly all placed in position.

Duplication of Pipe-line, Wallsend to Buttai Reservoir, Hunter River Supply.—This work was commenced in November, 1907, and the whole of the pipes, comprising 30,850 ft. $\frac{5}{8}$-in. thick, 7,400 ft. $\frac{3}{4}$-in. thick, and 17,450 ft. $\frac{13}{16}$-in. thick, making a total length of $10\frac{1}{2}$ miles of 20 inches diameter cast-iron pipes. Concrete piers are provided for carrying the pipes through ground containing acids. Provision has been made for connecting to Plattsburg Reservoir, also for Minmi, West Maitland, and Thornton. A Venturi meter is being obtained, which will be fixed near Buttai Reservoir. Both the 15-in. and 20-in. mains are now in order, and the present temporary connection will enable an additional 1,000,000 gallons to be delivered from Buttai to Newcastle.

Mittagong.—A contract for the construction of a storage dam on the Nattai Creek, a Monier service reservoir on a hill site commanding the township, with the necessary provision for engine-house, pump-well, rising and reticulation pipes, is now well in hand. The storage dam is well forward. A contract has also been let for the supply of the necessary pumping machinery for this work.

Murwillumbah.—A concrete service reservoir is being constructed, 66 ft. in diameter by a depth of 14 ft., and a capacity of 250,000 gallons, on the reserve commanding the town, as part of the permanent supply works.

A rising main and service main is also being laid for the use of the municipality for fire purposes. It is proposed to pump water from the river until such time as the permanent fresh water supply is obtained from Rocky Creek by gravitation.

Lismore.—Extra service pipes have been laid by the Municipal Council for lengths totalling $10\frac{1}{4}$ miles. This work has been carried out from revenue funds.

Wellington.—An additional pumping scheme is now in hand in connection with the supply of this town, the water being obtained from a pump-well sunk in the drift near the Macquarie River, and will be pumped into a Monier service reservoir, 33 ft. high and 50 ft. diameter, commanding the town. A contract is now being carried out for pump-well, engine-house, rising and service mains, and service reservoir.

The contract for the supply of the pumping machinery has also been let, and work commenced.

Cootamundra.—A submerged weir is being constructed by the Municipal Council as an addition to this water supply, with a view of adding to the storage in the drift.

Camden Weir, Nepean River.—The first of the compensation weirs on the Nepean River is now under construction, and will probably be completed early in August. The height of this weir above the river bed is 6 ft., and this will throw the water back about $2\frac{1}{2}$ miles.

The weir is of concrete, of the type known as "floating," having a line of sheet-piling 5 ft. deep at each end, with a concrete wall 6 ft. high, and a concrete apron. Between the upper sheet-piling and the concrete the bed of the river is lined with puddled clay.

Portland.—An additional pipe for bringing water down from the upper portion of the creek is being laid by the Blaxland Shire Council.

Canbelego.—Additional storage is being provided by the excavation of an additional 5,000 cubic yards of material from tank. The excavated material is being utilised to form wing banks for surface conservation, with a diversion drain to carry off polluted drainage from the town.

Since the rearrangement of the branch, referred to in my report, the supervision of these works has been under the direction of Mr. T. E. Burrows.

SEWERAGE CONSTRUCTION.

Metropolitan Area.

Iron Cove Creek Valley—Ashfield Stormwater Drainage.—A stormwater drain, 2,224 ft. in length, has been constructed from Alt-street to Orpington-street, at a cost of £2,981. The sewer varies in size from 6 ft. wide by 3 ft. 3 in. deep at the outlet end to 3 ft. 6 in. diameter at the upper end.

The lower end is open and is constructed of concrete, the upper and covered portion being formed of Monier pipes.

Rookwood Stormwater Drainage.—The frequent flooding of Joseph-street, Rookwood, caused the Municipal Council to apply to the Minister for some mitigation of the trouble, and a flood discharge channel has been constructed from James-street to junction with the creek below Joseph-street, a length of 700 ft. The channel is 9 ft. wide and 4 ft. 6 in. deep, and is open excepting under the roads.

The bottom of the channel is of concrete and the sides are of brickwork. The expenditure upon the work amounted to £1,426.

Waverley

Waverley Stormwater Drainage—Little Coogee Channels—Two small stormwater channels have been constructed in the Little Coogee Valley. The first channel was from Varna Park along the existing creek, terminating near Arden-street. The channel is about 800 ft. long, the lower portion being constructed of brick and concrete as an open drain 4 ft. wide and 3 ft. deep and the upper portion being of Monier pipe 2 ft. 6 in. in diameter.

The second channel is near Boundary-street, and was constructed to prevent the serious erosion that was taking place below Clifton-street. The channel is about 200 ft. long, consisting of 159 ft. of 2 ft. 6 in. diameter closed drain, and 50 ft. of open drain. Owing to the steep grade the construction was carried out in reinforced concrete.

The cost of the two channels was £1,174.

Marrickville Stormwater Drainage—Stanmore-road Stormwater Channel Extension—As a further extension of the Marrickville drainage, a connecting channel has been constructed from the channel across the northern end of the flats, terminating at Victoria-road, to join the channel constructed under the Stanmore-road.

The channel in its course passes under the Illawarra and Addison roads and other streets. Its total length is 3,400 ft. There are two branches, the first, running at the back of Cook's-road to Addison-road, is 880 ft. long, and the second branch, parallel to Jabez-street, is 560 ft. long.

The main channel is built as an open channel from the Victoria-road to the Illawarra-road, bridges being provided at roadways. This portion is constructed with a concrete bottom and brick sides, and diminishes in size from 8 ft. wide by 5 ft. deep to 7 ft. wide and 4 ft. 3 in. deep. From the Illawarra-road to its junction with the Stanmore-road channel, it is constructed of Monier pipes, ranging in size from 4 ft. 6 in. to 3 ft. 6 in. in diameter. The branches are of Monier pipes from 4 ft. 6 in. to 2ft. 6 in. in diameter.

The channel will drain an area of 317 acres, taking in portions of Marrickville and Newtown. The cost of the completed work has been £6,506.

Country Towns Sewerage Construction.

Parramatta Sewerage.—Fair progress has been made with the contracts for the sewerage of Parramatta, and a portion of the system will be in working order by the end of the year.

The septic tanks and filters are situated on the Parramatta River, near the outlet of the Clay Cliff Creek. The pumping station and collecting-wells are higher up the river, near the George-street Asylum. These works, together with the sewerage on the southern side of the river, are nearing completion.

On the northern side the sewerage is in progress, but is not far advanced.

The sewers, with the exception of a main line of Monier pipes, are constructed of earthenware pipes. As all the sewage has to be pumped, every effort is being made to ensure the pipe lines being water-tight. The pipes used are subjected to hydraulic pressure under a static head of 30 ft., and a bituminous compound has been substituted for cement as a jointing material.

These alterations from the past practice in sewer construction have given excellent results, the pipes being practically dry after the sewer trenches had been flooded.

The sewerage of Parramatta will serve a population of about 12,000 persons.

The expenditure, including the sum of £14,864 already spent on stormwater channels, is estimated at £66,123.

Narrandera Sewerage Extension.—An extension of the present system to Narrandera Hospital has been completed, the length, consisting of 6 in. and 9 in. pipes, being 2,046 ft.

Two other extensions near Audley-street have also been carried out, their combined length being 1,100 ft They consist of 6-in. pipes. Improvements were also effected at the septic tanks and filters.

The total expenditure on these works was £830.

Newcastle Sewerage.—Contract No. 720, Ventilation, 1st Division.—This contract was started on the 13th January, 1908, and completed on 16th May. Ventilation is now provided in that portion of the main outfall sewer and the reticulation sewers extending from the "Gulf," Merewether, and as far as Laman-street, Newcastle.

There are 36 induct and 63 exhaust shafts, including 2 18-in., 2 15-in., 8 12-in., 8 9-in., and 79 6-in. tubular vent pipes, totalling 3,600 feet, together with 4,600 lineal feet of earthenware pipes leading thereto, also 115 cubic yards of concrete work for special chambers. The total cost was £1,400.

Contract No. 726, Low Level, 1st Division.—This contract was started on the 22nd April, 1908, and up to the present time 11,000 lineal feet of sewers have been laid, consisting of 6-in. earthenware pipes. Good progress is being made with the work, which is to be completed by September next.

The particulars for the ventilation of the following divisions have already been forwarded for the purpose of preparing drawings for contract:—2nd division reticulation, city of Newcastle, and for the low level 1st division also in the city of Newcastle.

Up to the present time six contracts, viz., 392, 608, 611, 618, 623, and 635, representing an amount of £59,371, have been transferred to the Hunter District Water Supply and Sewerage Board. These contracts embrace the whole of the gravitation system, and the sewer lines are, therefore, ready for carrying out the duties required by them.

Stormwater Channels.

Wallsend-Plattsburg Stormwater Channel.—This channel was cleaned out and widened in November, 1907, extending from the Co-operative Coy's railway line through Wallsend Park, a distance of about 4,900 lineal feet. The channel has now been transferred to the municipalities interested.

Hamilton Park Stormwater Channel.—This channel extends from the end of the existing brick barrel drain constructed by the municipality of Hamilton, in a north-westerly direction through Hamilton Park, across Lindsay-street, a distance of 400 lineal feet. It is built of concrete, with rails in the crown, dimensions 4 ft. x 3 ft. An earth channel was extended for a distance of 1,500 lineal feet onwards to the main channel. Total cost, £330.

Drain through Show Ground, Broadmeadow.—This channel was extended through the showground just beyond its northern boundary in August, 1907. It consists of a pitched sandstone invert with concrete sides and top, which is supported by steel rails. Length 130 ft., dimensions 5 ft. 6 in. by 4 ft. Cost, £130.

II. SURVEY AND DESIGN.

Metropolitan Area.

Iron Cove Creek Pumping Station and Low Level Sewer.—The low level sewerage of the Western Suburbs of Sydney is being extended to the Iron Cove Creek Valley.

Contracts will shortly be let for the construction of a pumping station on a site near the creek, about a quarter of a mile north of the Parramatta-road. The present population served is 1,700, but is increasing so rapidly that it is estimated that, at the rate of progress during the last ten years, the population in twenty years will be over 7,000. The pumping machinery will consist of centrifugal pumps, vertically driven by electric motors. The machinery will be in duplicate, each unit being capable of lifting the total quantity of sewage. Current will be obtained from the Railway Commissioners' tramway power house, and automatic starters for the engines will be provided.

The station and machinery are estimated to cost £4,500.

Outfall Sewer to convey the Sewage from the Southern, Western, and Illawarra Suburbs of Sydney to the Pacific Ocean.—At the present time the sewage collected from these suburbs discharges into what is known as the Botany Sewage Farm, situated on a sandy peninsula at the junction of Botany Bay and Shea's Creek, where it is dealt with by precipitation and intermittent downward filtration; but, owing to the growth of the suburbs adjoining the farm, this method has become objectionable, and a proposal was made to abandon the farm and discharge the sewage into the ocean through a sewer about 6½ miles long.

The scheme recommended by Mr. L. A. B. Wade, Chief Engineer for Rivers, Water Supply and drainage, is for a gravitation sewer throughout, and has been exhaustively inquired into by two Parliamentary Standing Committees on Public Works. Owing principally to the opposition shown by outside witnesses, the Minister for Public Works had the scheme referred to three of the highest authorities on sewerage and hydraulics in England; their report, endorsing the gravitation scheme with certain modifications, has lately been received, and is now under consideration of the Public Works Committee.

It will connect with the existing sewers at the Botany Sewage Farm, from which it will be laid on a grade of 1 in 3,650, across undulating country, to discharge into the Pacific Ocean at a rocky headland on the north side of Long Bay. The grade will terminate at an air shaft near the sea cliffs, where the invert will be 2ft. 6in. below high water spring tides. From the air shaft two short outfall tunnels will lead the sewage into the ocean, 20 feet below high water spring tides, the soffit of each tunnel at point of discharge being through the face of a submerged cliff.

Starting on the Botany Sewage Farm, there will be a duplicate sewer 6 ft. 5 in. by 5 ft. to Cook's River, constructed partly in aqueduct and partly in trench. The sewer crossing of the river will be carried out as an inverted syphon, and in order to prevent obstruction to its soffit, will be 15 ft. below low-water spring tides. The duplicate sewer will continue partly on a concrete and brick aqueduct and partly in trench to twin tunnels to be constructed through about one mile of water-charged sandhills. The over-burden through the wet sand will range from 20 ft. to 70 ft. The outside diameter of these tunnels will be about 8 ft., and it is proposed to use shields driven by hydraulic pressure in the construction of this portion of the work. After passing through the wet sand country, the twin tunnels will converge into a single sewer 13 ft. 9 in. by 7 ft. 10 in., enlarging finally to 14 ft. by 8 ft. 8 in., constructed partly in tunnel in rock and partly in trench in rock, for a total distance of about two and a half miles to the air-shaft at Long Bay headland. At the outfall, special precautions to deal with the action of ocean waves during storms will be taken; the two outfall tunnels will be constructed in the solid rock on a steep grade, and gradually diverging so as to form a V with branches wide apart where finally discharging into the ocean at the vertical face of the submerged cliff.

Under this scheme the sewer, which will deal with the sewage from an area of about 26,000 acres comprised in the abovementioned suburbs, and a probable ultimate population of 657,000 persons, is estimated to cost £452,400.

Waverley Stormwater Drainage.—Owing to serious flooding that has taken place in the neighbourhood of Penkivil-street, Waverley, the Council has applied to the Minister for the construction of a channel to form an outlet for the stormwater of the valley. A survey of the creek has been made from the junction of Penkivil-street and the Old South Head Road to a point near the crossing of the Bondi outlet sewer. Plans have been prepared and a contract will be let for the construction of the sewer from Penkivil-street to near Hall-street.

The sewer will be built of Monier pipes increasing in size from 18 inches diameter at the head to 5ft. 6 in. at the outlet.

The estimated cost is £4,500.

Vaucluse Sewerage.—A scheme to drain the area north of the Northern Outfall Sewer, being portions of Woollahra, Waverley, and Vaucluse, between the ocean and Port Jackson, is under consideration, and levels have been taken, &c., to admit of an estimate and proposal being prepared for the consideration of the Public Works Committee.

The

The area about Watson's Bay is thickly covered with houses, and other portions are being built upon, especially on the east side of Rose Bay, all of which drain into the harbour.

The proposed sewer, some 2½ miles in length, will intercept this discharge and convey same to the main outfall sewer, where it will flow, untreated, into the ocean at Ben Buckler.

The ultimate population to be dealt with is 47,130.

Sewerage of Government Institutions.

Newington Asylum.—For many years past part of the sewage from the Newington Asylum has been discharged into the Parramatta River per medium of pipe sewers. The Harbour Trust having decided that the pollution of the river should be discontinued, a design has been prepared which provides for the interception of all sewage matter by a new pipe sewer, gravitating to septic tanks located in a remote corner of the institution estate. Subsequently to filtration the effluent will be pumped into existing elevated tanks, and thence gravitated throughout the cultivation areas for irrigating the crops. The existing sewers will be used to discharge rain water exclusively.

The estimated cost of the scheme is £2,600. The present population is 800, but will ultimately be increased to 1,500.

The drawings are in progress, and the construction of the work will be proceeded with shortly.

East Maitland Gaol.—A survey has been completed and a design prepared for the installation of a sewerage system for the East Maitland Gaol.

This institution was equipped with pipe-sewers which discharged all foul water, but fœcal matter was treated elsewhere. The proposed installation will intercept the foul water and excrementitious matter, but stormwater will still escape by means of the original pipes.

The sewage matter will be treated biologically within the grounds of the institution, and the effluent discharged into a watercourse remote from habitations.

The total estimated cost of the scheme is £800, and the maximum capacity of the gaol is 160 inmates.

Waterfall Hospital.—Amongst other public institutions the hospital at Waterfall, which is now approaching completion, is to be provided with an up-to-date sewerage installation. The site is about 3 miles south of Waterfall railway station, on the watershed of the Port Hacking River.

The scheme provides for a main gravitating pipe sewer, discharging into septic tanks. The effluent from these will be treated by double filtration and percolation over an irrigation area of practically unlimited extent.

The hospital will ultimately accommodate 500 inmates, and the total cost of the scheme will be about £1,100.

The working plans and sections are completed, and the work will be proceeded with almost immediately.

Berrima Gaol Sewerage.—Defective work having been found in the sewers of the Berrima Gaol the gaol was resewered, the old sewers being retained as rain-water drains. Treatment works, consisting of septic tanks and filters, were constructed, the works being so arranged that the effluent could be utilised for irrigating a portion of the gaol garden.

Newcastle Sewerage.—The low-level scheme has been revised and several pumping stations omitted from the design, deeper sewers on flatter grades being substituted. It has been found necessary, owing to the growing population, to include in the scheme several additional areas.

Surveys were carried out for the following works :—

The City low-level sewer from Union-lane to the Railway Bridge on the Maitland-road.

The Waratah main sewer, and the reticulation of Wickham, Islington, and Hamilton.

Hamilton Park Drainage.—A stormwater channel, 60 chains in length, was surveyed. This channel is designed to drain the low-lying parts of the municipality.

Goulburn.—The sewerage scheme designed for Goulburn is a composite one—part gravitation and part pumping.

The High-level Gravitating Sewer will have its outlet at the extreme north end of the town, after crossing the Wollondilly in aqueduct near its confluence with Mulawarree Ponds. Here the sewage will be treated biologically, and the effluent percolated through a percolation area of about 25 acres.

The total cost of the scheme is estimated at £45,700. The total length of sewers will be about 23½ miles, and will serve a population of 9,300.

Wagga Wagga.—A sewerage scheme for the town has been prepared.

The population of Wagga Wagga is about 6,000 persons, and is increasing rapidly. The scheme proposed is a pumping one, with biological treatment, to deal with present population, and sewers of sufficient capacity to deal with a prospective population of 14,000 persons. The town being divided into four districts, with a pumping station in each district, the sewage will be collected at each pumping station by gravitation, and then pumped through a rising main to the treatment works, situated near the river, on the outskirts of the town.

The total estimated cost of the scheme is £40,750.

Surveys and Designs for Sewerage and Stormwater Drainage.—Schemes of sewerage have been prepared for the towns of Albury, Katoomba, Lithgow, East and West Maitland, and Camden.

Extensions of the existing sewerage systems of Hay and Narrandera have been designed, and will be shortly carried out.

Sewerage Works are under the supervision of Mr. A. Peake, Assistant Engineer.

WORKS UNDER THE WATER AND DRAINAGE ACT.

Artesian Bores.

The works carried out in connection with the tapping of the artesian water in this State have been very satisfactory, and the progress made under the provisions of the Water and Drainage Act, as well as the previous work done, is shown in the following table :—

	Number of Bores.	Area Watered.	Length of Drains in Miles.	Cost.	Annual Revenue.
		Acres.		£ s. d.	£ s. d.
Under Artesian Wells Act	13	381,230	.....	26,583 0 0	1,193 15 5
Under Water and Drainage Act—					
Works gazetted over to Trusts, 1907-8	10	.....	.....	.....	.....
Works gazetted over to Trusts prior to 1907	9	1,272,061	663½	56,554 9 10	4,623 13 1
Trust Proposals gazetted 1907-8	10	784,000	501	38,853 0 0	.....
Trust Proposals constituted 1907-8	12	920,960	562	46,468 0 0	.....
					5,817 8 6

Preliminary work for fresh trust proposals, such as surveys, plotting and design, preparation and gazettal of proposals, &c., has been steadily proceeding ; also the preparation of contracts, inviting tenders, and progress of contracts for sinking bores, constructing drains and culverts, fencing, &c., incidental to the complete scheme for each trust district.

The survey for distributing channels and design for trust districts, to utilise to their fullest capacity the bores sunk on improvement leases that have been cancelled, is now being carried out.

The measuring of bore flows, pressures, temperatures, and the running of lines of levels to connect bores in the Moree, Walgett, Coonamble and Bourke districts, to enable the isopotential lines to be plotted, have been further extended, but this work has been delayed in places west of the Barwon owing to the absence of grass and water. When completed the information will be valuable in assisting to determine the sources of supply of artesian water.

The geological survey defining the intake areas is still in progress, and during the year under review has been carried on over an area from the Castlereagh River as far as Coonabarabran.

The total annual payments made by the Trusts to the Crown for sinking bores and construction of distributing channels, &c., under the Water and Drainage and Artesian Wells Acts, is £5,817 8s. 6d., and it is pleasing to record that payments are made regularly and are up to date.

In connection with the Bore Trusts under the Water and Drainage Act, the respective Works Officers for the districts in which the Trusts are situated are appointed by the Minister as Official Trustees on the various Bore Trusts. The satisfactory financial position and the smooth working of Trust matters generally are due in a large measure to the keen interest displayed by these officers in carrying out their duties under the Act.

For plan of Artesian Basin showing bores, &c., see Appendix.

Swamp Drainage.

During the year under review surveys have been made of 12 swamp areas, designs and estimates prepared, Trust proposals notified and work handed over to Trustees, as given in the following lists :—

Surveys have been made for the preparation of designs and Trust proposals under the Water and Drainage Act to drain the following swamps :—

On the Richmond River: Newrybar, Tuckean. On the North Coast: Duranbah, Mooball, Crabbe's, Billinudgel, Belongil. On the Macleay River: Frogmore, Glen Rock, Tennessee, Seven Oaks. On the Hastings River: Lake Innes and Lake Innes Swamp. On the Hunter River: Grahamstown and Campvale.

Trust proposals have been gazetted for the following drainage works :—

Cooroobongatti, Ulmarra, North Casino, Curl Curl Lagoon, Frogmore, and Trutes Bay.

Work handed over to Trust: Terranora.

Water Conservation Works.

Muggabah and Merrimageel Creeks.—A Trust District has been defined and Trust constituted to improve the channels of these creeks and the flow of water down same. Action has been taken to have the work carried out.

Tuppal Creek.—A trust under the Water and Drainage Act has been constituted, and works handed over to the trustees in connection with the cutting, with regulator, from the Murray River, to improve the flow of water down the creek.

Bullatale Creek.—A Trust proposal under the Water and Drainage Act has been notified ; the proposed works consist of a cutting from Woperana Creek, an ana-branch of the Murray River to Bullatale Creek, with regulator and embankment.

Thule, Eagle, Little Merran, Gulpa and Green Gully Creeks.—The question of improving the supply of water to the above creeks, by means of cuttings with regulators, to furnish a more permanent and equitable supply to the land bordering on same, will shortly be taken in hand, and the preliminary survey started with a view to their construction under the provisions of the Trust proposals of the Water and Drainage Act.

Edward River.—A proposition to improve the channel of the Edward River is under consideration, and as this river is the main source of water supply for a very extensive district, the undertaking, if carried out, would benefit a large area of country that has a poor rainfall, averaging 16 inches per annum.

Macquarie

Macquarie River.—The works on this river in the vicinity of the Warren weir, namely, the cuttings, with regulators, for the Gunningbar, Belaringar, Crooked and Duck Creeks, together with the Warren weir, have been maintained during the year by the Department. The question of further improving these works to increase their efficiency is under consideration, but the advantage of placing these works in the hands of Trustees under the provisions of the Water and Drainage Act, might well be considered before a further expenditure is incurred.

19 *Mile Dam.*—A Trust proposal has been notified in connection with this work. The matter is under reference to the Water Conservation Board for inquiry.

Algudgerie Creek Weir.—A Trust proposal has been notified in connection with this work. The matter is under reference to the Water Conservation Board for inquiry.

PILLIGA SCRUB.

The shallow bores being sunk in the Pilliga Scrub to supply water for the areas to be made available for settlement by the Lands Department are nearing completion. Pumps to be worked by wind-power; elevated tanks and troughing will be erected when bores are completed.

PUBLIC WATERING PLACES.

During the year the following works have been completed within the Shire area, and handed over to the Shire Councils :—Caigan Well, Marrar Tank, Boobah Well.

The following work has yet to be completed before being handed over to the Shire Council :—Walcha-road Well. Balldale Tank and Gemville Tank have been completed.

The following works are in hand :—Kennedy's Tank, Gardiner's Creek Tank, Fowlers' Gap Tank, Palmagertic Tank, Rowena Tank, Milparinka (additional) Tank, Four Tanks, Clare-Oxley road, Wallangulla Tank.

Since the rearrangement of the branch, referred to in my report, the supervision of these works has been under the direction of Mr. S. H. Weedon, assistant engineer.

WATER RIGHTS ACT, 1902.

During the twelve months, 109 applications have been made for licenses under the Water Rights Act. Sixty-three licenses have been issued, a few applications only have been disallowed, the remaining applications are now in the hands of the various Local Land Boards for inquiry. In addition, 36 renewals have been granted by the Minister.

WENTWORTH IRRIGATION AREA.

Following the approval of the Governor-in-Council in January last that the Minister for Agriculture be charged with the administration of matters relating to irrigation farms, the Wentworth Irrigation Area, previously under the control of this Department, was transferred to the Department of Agriculture. At the time of transfer 73 blocks, covering an area of 1,087 acres, were mads available for lease, of which 57 of the blocks, an area of, say, 762 acres, were taken up. In addition, 10 sites were set aside for business purposes, and all were in occupation.

RIVER GAUGING.

Since the beginning of the year, 192 separate observations have been taken at 37 gauging sites, distributed over 18 main rivers and tributary streams. With the additional assistance of a staff of Contract Draftsmen, it has been possible to plot 155 of these observations, and the construction of rating tables and calculation of monthly volumes is being rapidly proceeded with.

Lachlan River Storage.

The possibilities of storage at the Wyangala dam site and the probable volumes available for distribution below the dam have been fully investigated during the year. The very complete gaugings of the Lachlan at Cowra have furnished sound data upon which to design the dam, and the State will be spared the expense of constructing a storage in excess of the capacity of the river which supplies it.

Drainage maps have been prepared of the Lachlan basin, the mean annual and monthly rainfall of all stations therein tabulated, monthly run-off percentages computed, and diagrams prepared shewing the behaviour of dams of 160 ft. and 210 ft. high respectively during the past 14 years in supplying definite quantities for irrigation purposes below Wyangala.

To express the volumes supplied at Wyangala dam site in their equivalents at stations on the lower Lachlan, it is necessary to have complete gaugings of the main river and contributing streams below Cowra. This work is now in hand on the main river, and steps will be taken shortly to appoint a permanent reader, and take velocity observations of the Belubula River at a point near its junction with the Lachlan.

Advantage was taken of the last rise to extend the observations at Forbes, Condobolin and Euabalong, and it is probable that before long our knowledge of the lower Lachlan will be extensively added to. During the year, 39 observations were made between Condobolin and Oxley, and of this number 25 were measurements of stored water released from Lake Cudgellico.

Barren

Barren Jack Storage.

The effect of the Barren Jack Storage upon the natural flow of the Murrumbidgee has agitated the minds of residents of Old Man and Sandy Creek for some time past, and to set the matter at rest an elaborate series of calculations has been made to show how the Murrumbidgee at Wagga Wagga would have fluctuated had the dam been constructed in 1900, and operated upon in the manner prescribed from day to day during the past eight years. From the results of the calculations shown in diagram form, it is possible to determine how many days the Old Man and Sandy Creek's would have run under storage conditions.

Murrumbidgee.

At Gundagai 14 observations at medium and low stages were taken during the year, and several corrections were made in the rating table for the station as a result thereof. The daily behaviour calculations of Barren Jack Storage, already referred to, were made on the basis of these amended discharges.

Further velocity measurements were made at Wagga Wagga, Narrandera, Berembed, and Hay, 15 in all, and the plotting is now in hand.

Cotter River.

At the end of 1907 a gauge was erected, and permanent reader appointed to record the daily fluctuations of the Cotter, and 11 observations of discharge made at stages up to 2 ft. 2½ in. on the gauge. Before an adequate rating table can be prepared, and monthly volumes computed, further measurements at high stages are imperative.

Simultaneous measurements of the Murrumbidgee below Cotter junction showed that the Cotter was contributing about 14½ per cent. of the main river flow.

Tumut River.

Opportunity was taken of the exceptionally low flow of the Tumut River in April last to obtain minimum flow measurements, and the rating table has been altered in accordance with the results obtained.

Darling River.

In March of this year a considerable rise took place in the Darling River, and an officer was sent to Menindie station to gauge the river at all stages of the freshet. About seventy-four observations were taken on the rising and falling river, and the work of plotting and reducing the measurements is being actively pushed on. When completed, the data obtained should prove invaluable in connection with the rights of this State to an equitable proportion of the Murray waters under the terms of the Premiers' Agreement, and will doubtless be useful in discussing storage schemes at Lake Menindie and improvements to the great anabranch.

Namoi River.

At Narrabri, where a gauge has been continuously read for the past sixteen years, the highest flood on record was witnessed; and opportunity was taken to gauge the flow, not only of the main river, but of Narrabri Creek, and other flood openings, so that a very complete discharge was obtained. At some future time it is proposed to continue the work at Narrabri, in order that a complete discharge curve can be prepared.

Murray River.

Several velocity measurements of the Upper Murray at Indi and Swampy Plains and continuous records of daily heights are being kept, but no computations of volume can be attempted till the next rise is gauged. By arrangement with the Victorian Government, the gauging of the River Murray has been divided, so that this State will control the river above Albury and the former authority will gauge the lower river, thus putting an end to the duplication that formerly existed.

Hunter and Goulburn Rivers.

Early in March of this year an important rise occurred in the Hunter River, and supplied the long-wished-for opportunity for obtaining velocity measurements.

At Singleton observations up to 19 ft. 10 in. on gauge were made, and numerous gaugings at other stations on the main river and contributing streams were carried out while the rise lasted. Altogether about thirty-eight separate stages were gauged, and the plotting of the results is now in hand.

When complete, the data will be useful in designing flood-mitigation schemes, and projects for irrigation and power-supply purposes.

Miscellaneous.

Scattered gaugings at Mowambah, Jindabyne, Talbingo, and Narromine to the number of thirteen were made during the year, and these will be added to as opportunity arises.

Several new meters have been added to the equipment, including one specially designed for measuring low discharges. The appliances have been maintained in good order and efficiency.

The whole of this work has been carried out under the direction of Mr. H. Shute.

HARBOURS AND RIVERS.

The breakwaters and training-walls at the Richmond River, Newcastle Harbour, Port Kembla, and Crookhaven and Moruya Rivers were extended during the year a total distance of 3,260 feet. This length is somewhat less than in previous years, owing to the deeper water in which the walls have been constructed, and to the Newcastle works having been stopped early in the year.

During the year also a total of 6,092,684 tons of material was dredged from the various rivers, at an average cost of 3·85d. per ton.

On the whole, the navigation of the various rivers has been fairly well maintained, partly as the result of the continuous dredging operations, and partly the improved scour induced by the 38½ miles of training walls and breakwaters which have been constructed during the past seventeen or eighteen years.

Considerable difficulty has been experienced at times in navigating the entrances to the Tweed, Bellinger, Manning, and—in a lesser degree—some of the other rivers; in these cases it was found impossible to give relief with the bar dredges "Antleon" and "Tethys," owing to the small depth of water on the bar, narrowness of the channel, or other unfavourable conditions.

Tweed River.

Harbour Works.—No work on the breakwaters has been done since 11th August, 1904, the lengths remaining to complete the scheme of improvements being 282 feet and 852 feet on the northern and southern walls respectively.

Dredging.—The combined grab and suction dredge, "Sigma," besides making a small cut in Duroby Creek, excavated channels in the North Arm. A commencement was also made with dredging at Bird's Flat, Terranora Creek.

The suction dredge "Actor's" services were utilised deepening in the main river—Condong to Murwillumbah and Tweed Heads to Chindera, and in opening the channel behind the western training wall up to the Tweed Heads wharf. The deepening of the channel from the main river up Terranora Creek to the Dock was in hand at the end of the year.

Although the bar dredge "Tethys" was at the Tweed for nearly six weeks in February and March for the purpose of improving the bar, the weather and other conditions were such that work was only practicable for a few hours. Good use was, however, made of the time in deepening the inner crossing.

State of Entrance.—The mouth of the river is encumbered with large quantities of shifting sand, and the channel through the shoals changes in direction more frequently than perhaps any other river on the coast. The average depth on the bar at low water spring tides for the year was 6 ft. 1 in., and on the inner crossing 5 ft. 9 in.

Byron Bay.

Jetty.—This jetty is under the control of trustees, who raise some revenue and carry out minor repairs. The jetty and appurtenances are in good order, and no expenditure has been incurred by the Department on repairs during the year.

Richmond River.

Harbour Works.—The scheme of improvements in course of construction is that proposed by the late Sir John Coode (with some additions), and authorised in 1890 by Act 54 Vic., No. 9. The works were started in the latter half of 1889, and have been continued without interruption to date. The work in hand during the year was the extension of the Southern Breakwater.

Riley's Hill Quarry.—The stone deposited in the Southern Breakwater during the year was obtained from Riley's Hill Quarry, which is close to the river bank, some 19 miles upstream from the entrance. The rock is hard sandstone, and blocks up to 20 tons in weight are quarried and sent to the breakwater. The stone is conveyed on trucks by rail to the wharves, a distance of about half a mile from the quarry face, and lifted by means of 20-ton and 10-ton steam cranes into punts, which are then towed to the walls at Ballina. The output from the quarry for the year and its distribution were as follows:—

Southern Breakwater			33,769 tons.
Ballast for river bank protection			6,043 „
Quarry refuse—Roads	4,943 tons.		
Wharves	713 „		
Private sale	660 „		
		6,316 „	
Total			46,128 tons.

The cost of quarrying and loading into punts 33,769 tons for the Harbour Works was £5,395 4s. 9d., or 38·34d. per ton. The total stone taken from this quarry to date for the improvement works at the entrance has been 1,145,488 tons, costing £147,802 9s. 1d., or 30·96d. per ton. The average number of men employed during the year was 48.

Towing.—The stone punts were towed between Riley's Hill and Ballina by the steamer "Lilian." The quantity towed during the year was 33,769 tons, at a cost of £1,882 1s. 4d., or 13·40d. per ton. The total stone towed to date has been 1,145,488 tons, at a cost of £50,098 7s. 10d, or 10·49d. per ton.

Northern Breakwater.—No stone was deposited in this wall during the year. For the present length, weight of stone used in its construction and cost, see page 24 of Annual Report, 30th June, 1905.

Southern Breakwater.—The quantity of stone lifted from punts by the 20-ton steam derrick crane on the wharf, hauled by locomotive about one mile, and deposited in place, was 33,769 tons, extending the Breakwater 100 ft., or to a distance of 8,235 ft. from the original high water mark, or 1,680 feet past the first section, and leaving 320 feet to complete. The cost of hauling and tipping for the year was £2,346 13s. 3d., or 16·67d. per ton, and the total to date £35,571 15s. 10d., or 14·92d. per ton. The cost of stone in place, including quarrying, towing, hauling and tipping, was £9,623 19s. 4d. or 68·40d. per ton. The total

total quantity of stone in this Breakwater is now 655,029 tons, which has cost £156,144 10s. 7d., or 57·21d. per ton. The weight of stones used during the year was from 1 to 20 tons, and the depth of water into which they were tipped, from 30 ft. to 35 ft. at low water.

The allowance for depreciation of plant in the cost of the year's work on the Southern Breakwater amounts to £2,450 9s. 6d., or 17·41d. per ton.

The average number of men employed during the year was 75.

Dredging.—The deepening and widening of the channel through the indurated sand patch at Ballina has been continued throughout the year by the cutter and suction dredge "Dictys."

The suction dredge "Alesus" completed the deepening of the crossing at German Creek, and excavated channels at Emigrant Creek Depôt, Broadwater, and Swan Bay.

In the South Arm the grab dredge "Mu" lifted 23,540 tons from channels, the whole of the material being placed in baskets, and, by means of wire ropes and winch, dumped on the high banks of the River, well away from the influence of floods.

A crude machine, known as No. 52, has been re-fitted as a grab to meet the pressing demand for removal of rock in the North Arm, and improving Bungawalbyn Creek, but principally in opening up Dungarubba Creek.

For more than three months, the bar dredge "Tethys" was engaged on the bar and inner crossing, increasing the width of navigable channel to 400 ft. and depth to 12½ ft. at low water.

State of Entrance, &c.—The inner crossing moved further west towards the end of the year, and is now on a line tangential to the curve at lower end of the Middle Wall towards a point 500 ft. west of end of first section of Northern Breakwater. The average depth at low water spring tides for the year on the bar was 10 ft. 5 in., and on the inner crossing, 12 ft. 5 in.

There is a fairly good channel up river as far as Coraki for vessels drawing 10 feet, and to Lismore for those drawing 9 feet. The worst shoal that existed in the South Arm, viz., that at Oaky Creek Wharf has been removed, and there should shortly be a good channel to the head of navigation.

Clarence River.

Harbour Works.—All the works authorised by the Act 54 Vic. No. 13, with the exception of the removal of the submerged rocks in the entrance, were completed in August, 1903. The works to be done to complete the scheme of improvements proposed by the late Sir John Coode consist in the removal of the reef and the construction of the Northern and Southern Breakwaters. A portion of the latter wall, 1,350 feet, estimated to cost £77,440, was recommended by the Public Works Committee in 1903, but the necessary authorising Act remains unpassed. In December, 1907, the construction of the Northern Breakwater, 3,650 feet, at a cost of £208,500, was referred by Parliament to the Committee, and the inquiry is still in progress.

Dredging.—A channel was dredged by the ladder dredge "Minos" from the Railway Wharf to Duke-street, Grafton, and after making a cut in the vicinity of Susan Island, the dredge removed to Lawrence Crossing.

The grab dredge "Omega" was temporarily commissioned for service in South Gate Creek. This dredge was several times used as a crane for dismantling wharf, lifting heavy machinery, and repairing training walls, etc.

Both the bar dredges "Antleon" and "Tethys" have been employed on several occasions deepening the bar. The opportunity has also been taken to deepen the Iluka Channel, and that leading up to Yamba Wharf.

State of Entrance.—The average depth at low water spring tides on the bar for the year was 11 ft. 3 in., and on the crossing 11 ft. 1 in. Above the Iluka Crossing the river and tributaries are in a very satisfactory condition, so far as navigation is concerned, and no dredging is at present required, except where the "Minos" is now employed at Lawrence.

Woolgoolga.

Jetty.—A contract was let for renewing a number of piles and other defective portions of the jetty, and removing and re-erecting pig pens. A tender was also accepted for the removal of the existing old five-ton steam derrick crane at the outer end of the jetty, and the substitution of one of 7½ tons power. The latter was taken from the Woodford Island quarry, Clarence River, being no longer required in connection with the Harbour works.

Coff's Harbour.

Jetty, &c.—A number of the piles having become insecure, a contract was let for replacing them, erecting a landing stage and effecting sundry repairs. The volume of trade having rapidly increased during the past few years, additional storage accommodation became necessary, and a tender was accepted for the erection of a new shed (40 ft. by 30 ft.) tramway extension, roadway, etc. Some new trucks have also been provided and sundry minor repairs carried out.

Bellinger River.

Harbour Works.—The breakwaters and training-wall remain as described in Annual Report of 1905-6, page 53, no extensions having since been authorised.

Dredging.—Channels were cut by the pump dredge "Rho" at Regan's Crossing, Back Creek, and the crossing near the Bellinger Heads Wharf.

The dredge "Antleon" did a little work on the bar and inner crossing in August, but this shoaled almost immediately, and, the conditions being unfavourable, the dredge was withdrawn without any permanent improvement having been made.

State

State of Entrance.—Considerable inconvenience was suffered by shipping during the earlier part of the financial year, owing to the existence of a shoal opposite the mouth of the river, and the deepest water being in an intricate channel running in a northerly direction from the river mouth. In March the channel cut straight out in line with the South Breakwater, and has since remained in that position.

The average depth on the bar at low water spring tides for the year was 5 ft. 6 in., and on the Inner Crossing 5 ft. 3 in.

The river on the whole has remained in about the same state as it was last year, and not much inconvenience was suffered by shipping, except at the entrance.

Nambucca River.

Harbour Works.—The breakwater works were stopped on 13th October, 1903, and no action has been taken towards giving effect to the recommendations of the Public Works Committee, which inquired into the question of additional works in January, 1904.

Dredging.—The pump dredge "Tau" worked at School House Point, Stewart Island Crossing, and in Warrell Creek during the year.

During July and August the grab dredge "Iota" was temporarily commissioned to improve the Bowra Arm. In May, this dredge was again commissioned and commenced work in Taylor's Arm.

Two attempts were made by the "Antleon" to deepen the bar, but on each occasion had to be withdrawn before completion, owing to the time being lost waiting for favourable conditions, and the more pressing demands from other rivers.

State of Entrance.—The channel has been straight out in line with the northern breakwater during the whole year, but for about four months ended December it was somewhat narrow.

The average depth on the bar at low water spring tides for the year was 5 ft. 7 in., and on the crossing 5 ft.

The main river shoaled a good deal near the mouth of Warrell Creek, and caused trouble to drogher traffic. Bowra Arm has remained in a good navigable condition, but Taylor's Arm has a number of very shoal patches in it, and dredging was commenced in June with the "Iota," and was in progress at the end of the year. Warrell Creek has been dredged in the worst places, and, except at its junction with the main river, is in fair condition.

Macleay River.

Harbour Works.—A description of the permanent works designed for the improvement of this entrance, and the work carried out up to the date of suspending operations, will be found at page 53 of the Annual Report 1906-7.

The amount authorised by the Harbour Act, 63 Vic. No. 6, 1899, is £95,000, or—including the 10 per cent. margin allowed—£104,500, which, together with an expenditure of £14,953, which took place before the passing of the Act, makes a total of £119,453. Of this amount, £86,917 has been expended, leaving £32,536 to reach the possible limit.

The only work done during the year was at Spencer's Creek, where 120 tons of stone was supplied by contract at a cost of £24, and used to repair the upper end of the wall on Rudder's frontage near Shark Island. A large quantity of plant, tools, and stores from these works has recently been forwarded to the Pyrmont Depôt, Sydney.

Dredging.—The pump dredge "Groper" worked at Seven Oaks, Thornton's, and below Frederickton Wharf. Some deepening was also done at Kempsey in front of the North Coast S. N. Co.'s wharf, and the Public Wharf.

The dredge "Tethys" commenced dredging the bar in May, and was so engaged at the end of the year.

State of Entrance.—The general direction of the channel has been straight out, and there has been very little variation at any time during the year. The bar towards the end of the year carried somewhat less water than for several years past. The average depth at low water spring tides for the year was 7 ft. 5 in.

Little inconvenience has been suffered by shipping in other parts of the river, and steamers drawing over 9 feet have had little difficulty in going up to Kempsey, the head of navigation.

Hastings River.

Harbour Works.—Work was stopped on the Southern training-wall in October, 1901, since which no action has been taken towards completing other parts of the scheme.

Dredging.—There is no dredge stationed at this port. It has, therefore, been necessary to afford relief in the vicinity of the Port Macquarie wharves by utilising the services of the bar dredge "Antleon." A little work was also done on the bar.

State of Entrance.—From July, 1907, to May, 1908, the direction of the channel was E N.E from the outer end of training-wall; at the end of the year it was N.E. by E.

The average depth on the bar at low water spring tides for the 12 months was 6 ft. 4 in., and on the inner crossing 5 ft. 10 in.

The general state of the river has not varied much during the year, and, while some shoaling has taken place near Wauchope and elsewhere, there has been very little interference with the shipping. It is proposed to send a dredge to this river at an early date.

The wreck of the s.s. "Ballina," which has been lying near the entrance for many years, was blown up with explosives, and portion of the *debris* removed, giving a least depth over the wreck of 10 feet at low water.

Camden Haven.

Harbour Works.—Work on the training-walls was stopped on the 20th February, 1907, when practically the whole of the work recommended by the Public Works Committee in 1903 was completed.

Dredging.—The combined grab and pump dredge "Theta" was employed the whole year contending with the inrush of sand from the ocean, and which is continually shoaling the inner crossing and portion of the river above. Unfavourable

Unfavourable weather conditions hampered the operations of the "Antleon," employed deepening the bar.

State of Entrance.—The channel over the bar has maintained the one position throughout the year, being parallel to the line of the southern training-wall. The average depth on the bar at low water spring tides for the year was 3 ft. 3 in., and on the crossing 4 ft. 11 in.

The crossing at Kendall, Camden Haven River, was excavated by hand with shovels and punt.

A few shoals exist in Watson Taylor Lake, which it is proposed to remove when a dredge is available, besides which there is no obstruction to either the droghers or steamers.

A few snags were removed from Bobs Creek, Queen's Lake.

Manning River.

Harbour Works.—The construction of the breakwaters and training-walls, as authorised by the Act of 1899, Vic. 63, No. 7, was suspended in February, 1904, for want of funds, and no work has been carried out since, though a balance of £33,220 of the amount authorised remains unexpended.

Dredging.—The Harrington crossing unfortunately requires constant attention, and practically the whole of the pump dredge "Dorus" work has been there. A little work was also done by this dredge at Goat Island, Taree, but, as she proved unsuitable for the material to be lifted, the ladder dredge "Pluto" was commissioned, and started work on 27th June.

Several attempts have been made to work the "Antleon" on the bar, but the dangerous conditions have prevented anything appreciable being accomplished.

State of Entrance.—The difficulties in navigating this entrance referred to in last year's report continue.

The average depth at low water spring tides for the year on the bar was 7 ft., and on the crossing 6 ft. 9 in.

Some shoaling took place between Taree and Wingham, as the result of freshes in the river; but except for these small obstructions the river and tributaries above the Harrington Crossing are in very good condition.

Cundle Dry Dock.—A contract was let in December for widening the dock 10 ft., and lengthening at 12 ft., to admit of the largest dredges working on the rivers on this part of the coast being docked there instead of being brought to Sydney or Newcastle.

Cape Hawke Harbour.

Harbour Works.—No extension and repairs of the breakwater have been carried out since the works were stopped in 1901.

Dredging.—The pump dredge "Ulysses" dredged channels at Forster Crossing, Government Wharf to Miles Mill—Forster, at Porter's Mill—Tuncurry, Cockatoo Island, Bumble Point and Coolongolook.

Satisfactory results attended the work of the "Antleon," in deepening the bar.

State of Entrance.—For the first nine months of the year the channel was in a straight line with the breakwater, but subsequently worked round to a N.E. position from the end of the wall. The average depth at low water spring tides for the year on the bar was 3 ft. 9 in., on the Tuncurry Crossing, 5 ft. 2 in., and the Forster Crossing, 4ft. 8 in.

Port Stephens.

Dredging.—During the year the combined grab and pump dredge "Delta" was engaged cutting channels at Tea Gardens, Windy Woppa, Hawk's Nest, Shark Hole Reach, and Black's Crossing.

The grab dredge "Beta" also dredged at Corrie Creek, Monkey Jacket, Black Oaks, and Billy Barlow Reach. About 50 snags were also removed from the Myall River.

Newcastle Harbour.

Harbour Works.—A description of the works authorised by the Act of 1895, and the condition under which they have been carried out, is given in last year's Annual Report. Work was stopped in September, when the authorised limit of expenditure was practically reached.

Waratah Quarry.—The output of stone for the year was 11,718 tons, costing £979 8s. 1d., or 20d. per ton. The total stone obtained from this quarry to date is 548,763 tons. The average number of men employed during the year was 50, and 2 horses.

Towing.—The stone towed across the Harbour from the Carrington Wharf to that at Stockton weighed 4,823 tons, at a cost of £104 12s. 2d., or 5d. per ton.

Northern Breakwater.—During the year, this wall was extended 20 ft. or to chainage 2,980 ft. with 4,829 tons of stone of from 3 to 30 tons in weight, the cost of hauling and tipping being £578 4s. 9d., or 28d. per ton; and the cost in place, including quarrying, hauling, towing and tipping, £1,084 15s. 3d., or 53d. per ton. The depth of water at the tip head varied from 25 ft. to 26 ft. at low tide. The average number of men employed was 16, and 1 horse. The total quantity of stone deposited in this Breakwater to date is 367,703 tons, at a cost of £87,225 19s. 7d., or 57d. per ton.

Southern Breakwater.—The length added to this wall for the year was 25 ft. (the chainage now being 4,620 ft., in which 6,895 tons of stone of from 8 to 30 tons in weight were used. The cost for hauling and tipping was £313 1s. 0d., or 17d. per ton; or, including quarrying, £890 10s., or 37d. per ton. The depth of water at the tip head was about 36 ft. at low tide. The total stone deposited in the Breakwater under the 1895 Act is 179,557 tons, costing £35,757 7s. 11d., or 48d. per ton. Work was stopped in September, and the plant dismantled, but during February and March, the heavy seas dragged down 160 ft. of the sea face, and steps have been taken to make this good again.

Submarine

Submarine Rock Excavation, Inner Basin.—This work was continued during the year, the rock drilling being done by the "Cliona," and the lifting of the material by the grab dredges "Nu" and "Upsilon," and ladder dredge "Hunter. The areas excavated were 492 ft. x 25 ft. to 25 ft. deep, and 525 ft. x 25 ft. to 20 ft. deep, the quantity (exclusive of silt) being 10,019 tons at the cost, exclusive of dredging, £1,882 10s. 9d., or 3s. 9d. per ton. When this channel from the Outer Harbour to the Inner Basin is completed, it will have a width of 450 ft. and depth of 25 ft. at low water. The present navigable channel for deep draught vessels is 23 ft. at low water for a width of 200 ft.

Reclamation and Dredging.—The depositing in Throsby Creek by the "Castor" of dredgings lifted by the bucket dredges in the Harbor, referred to in last year's Report, was continued throughout the year, and 15 acres of land were reclaimed at North Carrington, most of which has been taken over by the Railway Commissioners in connection with their new compound.

The dredges "Tethys," "Jupiter" and "Juno" were engaged on the bar on various occasions, when the following work was done:—

"Tethys" and "Jupiter" 600 ft. long x 300 ft. wide x 22 ft. deep at low water.
"Jupiter" 1,000 ft. „ x 300 ft. „ x 22 ft. „ „
"Neptune" and "Juno" 200 ft. „ x 200 ft. „ x 25 ft. „ „

The work done in the harbour and up river by the other dredges was as follows:—

Shoal.	Dredge Employed	Shoal.	Dredge Employed.
The Basin	"Glaucus." "Upsilon." "Samson." "Juno." "Neptune."	Upper Stockton Jetties	"Upsilon."
		9 and 10 „ „	"Upsilon."
		No. 1 Stockton	"Upsilon."
		Market Wharf	"Upsilon."
		Stockton Coal Wharf	"Juno." "Neptune."
Basin Entrance	"Nu." "Upsilon." "Hunter."	Hereford-street Wharf	"Nu."
		N. and H. R. S. S. Co.'s Wharf	"Upsilon."
North Harbour	"Newcastle."	No. 3 Crane, Dyke	"Upsilon."
King's Wharf	"Hunter."	No. 1 Buoy	"Hunter."
„ „	"Upsilon."	No. 3 Buoy	"Neptune."
No. 5 Buoy	"Juno."	Morpeth	"Neptune."
North Carrington	"Castor."	Raymond Terrace	"Neptune."
Stockton Jetties	"Hunter."		

Wharves.—During the year seven new mooring dolphins were erected on the western side of the Basin, and one at Stockton. Authority was given by the Newcastle Wharfage Act, No. 3, 1907, to construct a timber wharf, extending westerly 1,200 feet from a point 300 feet westerly from the foot of Merewether-street, Newcastle, and to erect thereon two goods sheds. This wharf is to be used mainly for inward cargoes. Good progress was made with the Monier plates and walings to hold up the ballast backing, and a start was made with the driving of piles for the wharf. A wharf was also erected by the Department for the Raymond Terrace Council. Lengths of 680 feet of King's Wharf and 493 feet of the N. and H. R. S.S. Co.'s Wharf were repaired and extended 10 feet outwards to obtain a greater depth of water. Nos. 1 and 2 ballast jetties were renewed and made available for the shipment of timber. Various wharves, &c., in the Port have been maintained, and miscellaneous repairs have been carried out to the Dyke Wharf for the Railway Commissioners.

State of Entrance.—The following table shows the depth on the bar, and least width and depth of navigable channel during the year:—

Month.	Depth on Bar at L.W.S.T.	Width and Depth of Navigable Channel.
July	22 feet	350 ft. x 22 ft.
August	22 „	300 „ x 21½ „
September	22 „	300 „ x 22 „
October	21⅞ „	300 „ x 21 „
November	21¼ „	300 „ x 21¼ „
December	21 „	300 „ x 21 „
January	22 „	300 „ x 22 „
February	22 „	350 „ x 22 „
March	22 „	350 „ x 22 „
April	22 „	350 „ x 22 „
May	22½ „	350 „ x 22 „
June	22½ „	350 „ x 22 „

The navigable channel through the Harbour Entrance has been kept clear of shoals, the minimum depth being 21 ft. in December, and width 300 feet. In January the bar dredge, "Jupiter," arrived, and by the end of the month the depth had been increased to 22 ft. and at the present time is 22½ ft. for a width of 350 feet. The channel now in use, that is, on the towers-in-line, cannot be deepened much more than this, owing to rock being met with in the centre of the channel, so the "Jupiter" is now at work endeavouring, by dredging near the Northern Breakwater, to induce the current to keep that part of the entrance clear. There is also a shoal opposite the end of the Northern Breakwater on the western side of the navigable channel which is continually making, the depth there at present being 21 ft. The dredging near the Northern Breakwater has been successfully proceeded with, and there is deep water within 300 ft of the breakwater, where there formerly was only 12 ft.

The "Regent Murray" wreck, which projected from the Harbour side of the Northern Breakwater, is now being removed.

Some

Some snagging was done in the Paterson River, but the floods in March brought down fresh snags which will require early removal.

Miscellaneous.—The following miscellaneous works were also carried out during the year:—Sinking shaft, Dungog Water Supply; temporary Water Supply at Cessnock; Hunter River Flood Gauging; repairs, High-street Embankment, West Maitland; survey, Singleton Water Supply; completion of Dyke Workshops; repairs to loco. for Port Kembla; Ballast Appliances, and various small surveys; repairs were effected to plant, and other work carried out for the Navigation, Explosives, Health, and Police Departments.

Lake Macquarie.

The pump dredge "Theta" was engaged deepening the channel near the Swansea Wharf, Lake Macquarie. A new wharf was built at Toronto, and handed over to the Shire Council.

Hawkesbury River.

Mangrove and Webb's Creeks, on the Hawkesbury, have been cleared of snags.

The dredging of the channel in approach to the proposed wharf at Woy Woy has been completed by the pump dredge "Zeta," the material raised being used for reclamation purposes.

The reclaiming of the low-lying area near the Brooklyn Station, towards which the Railway Commissioners have contributed the necessary ballast for the Dyke, and also the Monier pipes for drainage, was started towards the close of the year. The wall is now in position, and the dredge "Zeta" is pumping in behind the dyke material dredged from the bay.

Sydney Harbour.

The removal of silt from Long Cove Canal, between the tramway bridge and the footbridge, and which had become a nuisance, has been proceeded with during the year; and repairs were also effected to the stone pitching along the banks of the canal. Both these works were in progress at the end of the year.

An amount of £700 was made available for protecting the foreshores near the Newington Asylum, and at the end of the year the work was approaching completion.

Minor repairs were effected to Man-o-war Steps, Fort Macquarie; and to the drains, etc., in the Botanic Gardens.

Botany Bay.

Cook's River and Shea's Creek.—The protection of the Cook's River bank below the Shea's Creek junction was continued during the year. At Bonnie Doon the river bank was also protected and the outlet lowered. At the upper end of Shea's Creek Canal, the pump dredge "Gamma" was put on to remove the deposits which had accumulated there, hindering navigation and causing a nuisance.

The reclamation and deepening works at the confluence of Cook's River and Wolli Creek have been proceeded with; the formation of the oval, and concrete drain and Monier pipe outlet, were completed, together with the filling up of a considerable portion of the area to be reclaimed.

Botany.—The building of a sea wall at Springvale was undertaken to prevent the road and tramway being damaged by the erosion of the bank through the wave action. The wall has been built of heavy stone, with a ballast apron at the toe; one half the cost of this work is to be borne by the Railway Commissioners. A low wall, to protect the foreshore west of the Botany pier, and act as a trap for seaweed and sand, has also been built.

The Marine Parade, Lady Robinson's Beach, commenced in 1906-7, was completed. The work comprises 2¼ miles of ballasted and gravelled road, which now forms an attractive drive. An extension of this road near Saywell's, Brighton-le-Sands, was also almost completed at the end of the year.

An approach was formed to the causeway over Kogarah Bay at Ramsgate-road, and the following minor works carried out:—Jetty at Boney-street, Kogarah; boat jetty at Kogarah causeway; deepening at foot of Endeavour-street; ballast bank at Bay-street channel, Botany; repairs to Villa and Hermann streets, and President-avenue, Rockdale; and repairs to Liverpool dam.

Wollongong.

The fences round the sand drift area were repaired, and two tons of Marram grass obtained from Port Fairy, Victoria, and planted as a start in the attempt to stop the sand drifting over the reserve at Wollongong beach.

Port Kembla.

Harbour Works.—A description of these works and the conditions under which they are being carried out is given in last year's annual report.

The output of stone from the quarry for the year was 134,129 tons—three cranes being used. Of this, 41,840 tons, or about one-third, being too small for the eastern breakwater, was used for reclaiming and building the embankment for approach to new jetty, etc. The remainder, 92,289 tons, was sent to the eastern breakwater, extending it 315 feet, or to chainage 1,960 feet. The cost of stone tipped in the breakwater during the year, including the proportionate cost of opening quarry, and a percentage for depreciation of plant, was £15,416 14s. 11d., or 40·09d. per ton. The total quantity of stone deposited in the breakwater to date is 412,382 tons, costing 47·84d. per ton.

The face of stone in the quarry is now about 55 feet high, and is of excellent quality, and the breakwater construction is now being carried on at a rate considerably less than that estimated.

New

New Jetty, &c.—A contract was let in January for the erection of a jetty between the eastern breakwater and the Mount Kembla Company's jetty, for use principally by the Australian Smelting Company, and the Electrolytic Refining and Smelting Company, which latter company acquired from the department an area of about 52 acres, and proceeded shortly afterwards with the erection of extensive buildings, plant, etc. The railway line, constructed on the resumed land by the Australian Smelting Company, was acquired by the department, and a short line was laid connecting the Electrolytic Company's works with the Government lines.

Kiama Harbour.

A concrete sea wall, 300 feet long, and embankment, were built along portion of the foreshore of Brighton Beach, forming a promenade.

Crookhaven River.

Harbour Works.—During the year the Numbaa Point Training wall was extended upstream to the Comarong Ferry Crossing, a distance of 1,800 feet, the weight of stone quarried at Nowra, punted down, and put in place, being 5,600 tons, costing 36·94d. per ton. The total length of wall built to date is 4,100 feet.

The Roseby Park Wharf approach was also repaired with stone at a cost of £50, and the river bank at Nowra Wharf was also protected at a similar cost.

State of Entrance.—No difficulty has been experienced by shipping in crossing the Crookhaven River bar. The channel inside has, however, given considerable trouble, owing to the southern point of Comarong Island having been washed away. In consequence the channel has been narrow, tortuous, and shallow. The average depth on the bar at low-water spring tides for the year was 11 ft. 11 in., and on the crossing 5 ft. 4 in.

Dredging.—The bar dredge "Antleon" worked from 13th March to 2nd May, cutting a more direct channel through the lower crossing, which, however, shoaled again to 5 feet 6 inches within two months.

Ulladulla Harbour.

The inner face of the approach to the Ulladulla pier over a length of 312 feet was repaired with concrete, the stone facing having given way.

Bateman's Bay. 1908

No additions have been made to the Training-wall during the year. There is good water along the concave side of the wall, but the bar has shoaled somewhat, though there has been no interference with navigation. The average depth on the bar at low-water spring tides was 5 ft. 11 in.

Moruya River.

Harbour Works.—The plant at Bateman's Bay was taken to the Moruya, and the work of extending the lower Southern Training-wall restarted by day labour. A small wharf was erected at the Pompey Point Government quarry, and operations on the wall were commenced in February. The granite is punted from the quarry to the wall, and thrown into place by hand. The wall was advanced 1,000 feet during the year to chainage 3,841 feet, with 11,960 tons of stone, at a cost of 33·83d. per ton.

Dredging.—The combined grab and pump dredge "Eta" worked in the lower portion of the river—between Pompey Point and the breakwater—for six months.

State of Entrance.—The average depth on the bar at low-water spring tides was 7 ft. 5 in., and on the crossing 7 ft. 4 in.

Wagonga River.

Dredging.—The dredge "Eta" was sent from the Moruya to this river early in February, and worked in the channel from Post-office Point, Narooma, towards the sawmill.

The depth on the bar and inner crossing at the end of the year was 6 feet at low-water spring tides

MISCELLANEOUS.

Bermagui.—Minor repairs were effected to the decking of the wharf.

Tathra.—New fenders were fitted to the wharf, and a contract was let for the erection of a new two-storied weatherboard goods shed on the wharf, also cattle yard, &c.

Merimbula.—A concrete sea wall was built at the side of the wharf to hold up the road and prevent damage being done by the heavy seas. The goods shed was also shifted to a new position and an addition made to it, doubling the capacity. Other smaller works were also carried out.

Eden.—A contract for new fenders on the jetty was completed during the year.

DREDGE SERVICE.

The year's work as shown in attached detailed statements amounts to 6,092,684 tons, costing £97,752 15s. 11d., and averaging 3·85d. per ton.

The figures must be regarded as highly satisfactory, for notwithstanding that the price of labour, stores, materials, and coals, has increased considerably of late years, the average cost of dredging has not increased during the last 20 years. The following shows the record :—

Average from	January,	1875	to	December,	1887	... ...	7·60d. per ton
„	„	1888	to	June,	1898	... ...	3·85d. „
„	July,	1898	„		1908	... ...	3·85d. „
„	January,	1875	„		1908	... ...	4·48d. „

The

The dredge "Jupiter" was recommissioned in January, after undergoing extensive repairs and conversion into a trailing suction dredge, and has taken up the dredging for the improving of the bar at Newcastle Harbour. The "Antleon" and "Tethys" are thus freed from this work to attend to similar requirements at the coastal river entrances.

A 600-ton barge was launched at Fitzroy Dock in June, but it is not yet in commission, there being a considerable amount of work to do in completing the hydraulic door lifts. This is the first punt in the service on which such lifts have been specified.

After nearly 10 years of rough usage the lightly constructed hull of "Antleon" has deteriorated beyond the limit of safety, and immediate steps must be taken to extensively renew the plating. Considering the hazardous nature of operating on shallow bars, it is a subject for congratulation that this vessel and the "Tethys" have escaped serious disaster.

An order has been placed with the Fitzroy Dock for the construction of three hopper barges of 550 tons capacity for use at Newcastle. The necessity for this additional plant has suddenly become very pressing owing to the Superintendent of Navigation having increased the distance where silt may be deposited, thereby making it impracticable to maintain the former output of dredges sending spoil to sea.

The old condemned dredges, "Archimedes" and "Fitzroy," were sold during the year.

To meet the pressing demands for the improved facilities for navigation, and to maintain the long lengths of rivers and creeks in a navigable condition, the whole of the plant is now in commission, and in some cases double shifts are being worked.

The plant has been maintained in good working order, but, as pointed out in a previous report, there is necessity for constructing new plant to replace that which cannot be economically worked much longer.

The general supervision of Harbours and Rivers work is under Mr. W. Rossbach, the dredging operations being in charge of Mr. T. F. Rossbach, while Mr. A. M. Howarth is responsible for the design and efficiency of the dredging plant.

Ladder Dredge.	Where working.	Material lifted.	Tons lifted.	Hours dredging.	Hours working.	Expenditure.	Pence per ton.	Cost per hour dredging.	Cost per hour working.	Percentage of working hours.							Remarks.
										Dredging.	Coaling.	Removals.	Bad weather.	Waiting for punts.	Repairs.	Other causes.	
						£ s. d.	d.	£ s. d.	£ s. d.								
"Samson"	Newcastle	Mud and sand	499,880	2,398	3,131	3,347 5 5	1·80	1 7 6	1 1 4	76	3	6	2	4	7	2	
"Newcastle"	do	Mud and sand	489,250	2,078	2,423	4,480 18 2	2·44	2 3 1	1 17 0	86	2	4	4	...	3	1	
"Hunter"	do	Sand and stone	144,280	1,930	2,424	2,930 0 4	4·87	1 10 4	1 4 2	80	3	3	1	2	10	1	
"Ulysses"	Cape Hawke	Sand	91,763	1,061	2,441	2,288 3 2	5·98	2 3 1	0 18 4	43	3	14	1	...	28	11	
"Minos"	Clarence River	Mud, sand, shingle, and clay	185,220	1,767	2,431	2,179 2 9	2·93	1 4 7	0 17 11	73	3	11	...	...	12	1	
"Pluto"	Manning River	Shingle	1,820	12	65	157 9 3	20·76	13 2 5	2 8 5	18	...	31	...	14	37	...	Out of commission till June, 1908.
		Totals	1,412,213	9,246	12,915	15,382 19 1											
		Averages					2·61	1 13 3	1 3 10	63	2	12	1	3	16	3	

STATEMENT of Sand-pump Dredge Expenditure for twelve months ending 30 June, 1908.

Sand-pump Dredge.	Where working.	Material lifted.	Tons lifted.	Hours dredging.	Hours working.	Expenditure.	Pence per ton.	Cost per hour dredging.	Cost per hour working.	Percentage of working hours.							Remarks.
										Dredging.	Coaling.	Removals.	Bad weather.	Silt to sea.	Repairs.	Other causes.	
						£ s. d.	d.	£ s. d.	£ s. d.								
"Neptune"	Newcastle	Sand and mud	263,000	616	2,486	2,804 7 11	2·56	4 11 1	1 3 4	25	2	...	4	50	19	...	
"Juno"	do	Sand	205,000	649	2,430	2,735 16 3	3·20	4 4 3	1 2 6	27	3	1	5	46	18	...	
"Jupiter"	do	Sand	360,000	470	1,381	6,792 8 9	4·53	14 9 0	4 18 4	34	4	10	5	37	9	1	£6,864 8s. 5d. for converting into trailing dredge not included.
"Castor"	do	Sand, mud, clay, shell	625,101	2,165	4,835	5,648 3 6	2·17	2 12 2	1 3 4	45	4	10	...	...	40	1	
"Actor"	Tweed River	Shingle, sand and mud	253,508	1,301	2,433	2,144 12 10	2·03	1 13 0	0 17 7	53	3	26	...	...	14	4	
"Alesus"	Richmond River	Sand, clay, and stone	64,766	555	2,707	3,765 14 1	13·95	6 15 8	1 7 10	21	3	15	...	1*	59	1	Renewed and fitted boiler, and extensively overhauled.
"Dorus"	Manning River	Shingle and sand	121,783	1,174	2,371	2,544 14 1	5·01	2 3 4	1 1 6	50	5	30	...	...	14	1	
"Dictys"	Richmond River	Indurated sand	39,018	1,760	2,539	3,816 0 0	23·47	2 3 4	1 10 1	70	4	8	1	1*	15	1	Working in indurated sand principally.
"Groper"	Macleay River	Sand and mud	114,299	843	2,438	3,946 13 10	8·29	4 13 8	1 12 5	35	3	11	...	...	48	3	New pump fitted, and dredge extensively overhauled.
"Glaucus"	Newcastle	Sand	1,051,000	1,035	2,424	4,439 4 9	1·01	4 5 9	1 16 7	43	4	5	2	25*	17	4	
"Antleon"	Nambucca R., Bellinger R., Clarence R., Shoalhaven, Cape Hawke, Manning R., Macleay R., Port Macquarie, Camden Haven.	Sand	250,750	597	2,705	5,952 12 5	5·70	9 19 5	2 4 0	22	5	7	12	32	15	7	
"Tethys"	Newcastle, Richmond R., Clarence R., Tweed R., Macleay R.	Sand, shell and shingle	374,090	811	2,607	5,919 3 5	3·80	7 6 0	2 5 5	31	3	7	6	30	21	2	
		Totals	3,722,315	11,976	31,356	50,509 11 10											
		Averages					3·26	4 4 4	1 12 3	28	3	5	6	39	17	2	Self-loading dredges.
										45	4	15	...	4	30	2	Stationary dredges.

* Waiting for punts.

Statement of Combined Grab and Sand-pump Dredge Expenditure for twelve months ending 30 June, 1908.

Combined Grab and Sand-pump Dredge.	Where working.	Material lifted.	Tons lifted.	Hours dredging.	Hours working.	Expenditure.	Cost per ton.	Cost per hour dredging.	Cost per hour working.	Percentage of working hours.							Remarks.
										Dredging.	Coaling.	Removals.	Bad weather.	Waiting for punts.	Repairs.	Other causes.	
						£ s. d.	d.	£ s. d.	£ s. d.								
"Gamma"	Cook's River	Sand, mud, stone, roots, etc.	45,756	390	803	577 15 6	3·03	1 9 7	0 14 5	48	4	37	...	...	...	10	
"Delta"	Lake Macquarie and Myall River	Sand, clay and shell ...	125,520	1,531	3,255	2,077 17 9	3·97	1 7 2	0 12 9	47	3	33	...	...	14	3	
"Eta"	Moruya and Wagonga River	Sand and shingle.....	148,464	1,498	2,430	1,522 2 9	2·47	1 0 4	0 12 6	62	...	23	...	...	11	4	
"Theta"	Camden Haven	Sand	142,160	1,479	2,441	1,661 2 4	2·80	1 2 6	0 13 7	61	3	14	...	...	20	2	
"Sigma"	Tweed River.....	Sand, mud and clay	67,150	2,671	4,554	1,652 1 6	5·90	0 12 4	0 5 1	59	2	8	...	...	27	4	
"Rho"	Bellinger River	Sand	80,317	1,299	2,431	1,660 12 3	4·90	1 5 7	0 13 8	54	4	12	...	...	25	5	
"Tau"	Nambucca River.....	Sand, shell, gravel and quartz	129,263	1,439	2,438	1,901 8 11	3·53	1 6 5	0 15 7	59	4	18	1	...	17	1	
"Zeta"...	Woy Woy	Sand and mud	24,500	244	620	1,125 9 10	11.02	4 12 2	1 16 3	39	3	54	...	...	4		£3,693 15s. 1d. for conversion into suction dredge not included.
		Totals	763,130	10,551	18,972	12,178 10 10											
	Averages.....						3·83	1 3 1	0 12 10	54	3	25	...	...	15	3	

Statement of Grab Dredge Expenditure for twelve months ending 30 June, 1908.

Grab Dredge.	Where working.	Material lifted.	Tons lifted.	Hours dredging.	Hours working.	Expenditure.	Pence per ton.	Cost per hour dredging.	Cost per hour working.	Percentage of working hours.							Remarks.
										Dredging.	Coaling.	Removals.	Bad weather.	Waiting for punts.	Repairs.	Other causes.	
						£ s. d.	d.	£ s. d.	£ s. d.								
"Beta"	Myall River	Sand and mud	32,619	1,185	2,429	951 5 10	7·00	0 16 1	0 7 10	49	2	8	3	11	21	6	
"Iota"	Nambucca River	Gravel	9,092	459	813	425 11 11	11·23	0 18 6	0 10 6	56	2	18	...	...	15	9	
"Mu"	Richmond River	Sand and gravel	23,540	1,242	2,448	1,109 4 5	11·31	0 17 10	0 9 1	50	1	18	2	...	16	13	
"Nu"	Newcastle	Rock, mud, sand, clay	38,000	4,147	5,180	1,507 19 11	9·52	0 7 3	0 5 10	80	2	6	...	1	9	2	
"Omega"	Clarence River.....	Hard sand	19,850	742	1,498	244 5 1	2·95	0 6 7	0 3 3	50	...	8	...	...	24	18	
"Upsilon"	Newcastle	Sand, stones and timber	57,215	3,278	5,165	1,574 19 5	6·61	0 9 7	0 6 1	64	1	6	...	3	24	2	
No. 52	Richmond River	Hard sand, rock, mud and weeds	14,710	1,291	2,367	649 8 0	10·59	0 10 1	0 5 6	55	2	13	...	...	13	17	
		Totals	195,026	12,344	19,900	6,462 14 7											

Name of Tug.	Where employed.	Tons towed.	Miles run towing.	Miles run special service.	Total working hours.	Hours attending.	Cost of towing.	Cost of special service.	Cost per ton.	Cost per mile towing.	Cost per mile special service.	Cost per hour working	Cost per hour attending.	Percentage of working hours.					Remarks
														Steaming.	Coaling.	Repairs.	Bad weather.	Other causes.	
							£ s. d.	£ s. d.	d.	s. d.	s. d.	s. d.	s. d.						
"Ceres"	Newcastle	401,640	8,388	2	2,554	2,112	1,445 14 8	6 10	·86	3 5	3 5	11 4	13 8	64	2	17	3	14	
"Orestes"	do	431,890	9,901	.....	2,513	2,204	1,477 16 11	.....	·82	3 0	...	11 9	13 5	69	2	12	3	14	
"Rhea"	do and Coast	291,420	6,509	2,519	2,947	2,509	1,470 19 6	81 13 11	1·21	4 6	0 8	10 6	12 4	61	2	15	5	17	
"Galatea"	do	443,730	10,214	196	3,005	2,607	1,320 12 4	55 8 6	·71	2 7	5 8	9 2	10 7	63	2	13	2	20	
"Dooribang"	do	232,700	7,206	1,177	2,757	2,304	1,104 7 7	257 15 4	1·14	3 1	4 5	9 11	11 10	60	2	16	3	19	
"Dione"	Richmond River, and Manning River	46,119	2,292	.....	1,201	845	360 0 6	.....	1·87	3 2	...	6 0	8 6	52	2	30	...	16	
"Phœnix"	Newcastle	1,690	80	4,681	2,502	2,320	11 14 5	838 2 1	1·66	2 11	3 7	6 9	7 4	59	1	8	3	29	
"Athena"	Clarence River	185,220	6,918	323	2,548	2,367	644 0 5	20 9 10	·83	1 10	1 3	5 3	5 7	80	2	7	1	10	
"Ganymede"	Newcastle	3,690	216	4,623	2,641	2,462	17 7 9	838 17 11	1·13	1 7	3 8	6 6	6 11	48	1	7	...	44	
"Callisto"	Myall River	5,750	2,151	155	1,602	1,373	246 5 2	12 0 10	10·28	2 3	1 7	3 3	3 9	40	6	14	...	40	
"Yimmang"	Newcastle	.....	.....	7,446	2,465	2,330	.....	382 17 5	...	...	1 0	3 1	3 3	87	1	6	...	6	
"Burunda"	Newcastle and on Coast.	118,060	3,057	7,406	3,768	3,363	983 0 6	831 17 5	2·00	6 5	2 3	9 7	10 9	49	1	11	8	31	
"Wollombi"	Newcastle	297,920	5,904	646	2,509	2,054	1,118 15 0	148 14 2	·90	3 9	4 7	10 1	12 4	65	2	13	2	18	
"Minerva"	do	48,115	1,414	2 961	1,329	1,329	160 6 5	224 19 10	·80	2 3	1 6	5 9	5 9	76	3	...	...	21	
"Powerful"	do	.....	.....	2,460	2,410	2258	.....	731 13 2	...	...	5 11	6 1	6 6	20	...	6	2	72	
	Totals	2,507,944	64,242	34,595	36,751	32,437	10,361 1 2	4,424 17 3											
	Averages								·99	3 3	2 7	8 1	9 1	59	2	12	2	25	

COMPARATIVE Statement of Quantity and Cost of Work done by Ladder Dredges (with towing), for periods as stated.

Ladder Dredge.	Where working.	1 July, 1906, to 30 June, 1907. Dredging, Towing, and Repairing.			1 July, 1907, to 30 June, 1908. Dredging, Towing, and Repairing.			Remarks.
		Tons.	Expenditure.	Pence per ton.	Tons.	Expenditure.	Pence per ton.	
			£ s. d.	d.		£ s. d.	d.	
"Samson"	Newcastle	421,260	6,389 13 2	3·64	499,880	5,680 13 6	2·73	
"Newcastle"	do	498,340	7,137 3 5	3·44	489,250	6,527 1 1	3·20	
"Hunter"	do	190,200	4,250 7 4	5·36	144,280	3,890 5 4	6·47	
"Vulcan"	do (Laid up)	.....	76 15 7	.....	.....	.....	.....	Sold.
"Ulysses"	Cape Hawke	134,861	2,067 15 5	3·68	91,763	2,293 13 2	6·00	
"Minos"	Clarence River	103,320	3,798 13 8	8·82	185,220	2,823 3 2	3·66	
"Fitzroy"	Laid up	.....	377 2 7	.....	.....	.....	.....	Sold.
"Pluto"	Manning River	76,660	1,540 16 7	4·82	1,820	231 16 1	30·56	
"Archimedes"	Laid up	.....	90 8 0	.....	.....	.....	.....	Sold.

Comparative Statement of Quantity and Cost of Work done by Sand-pump Dredges (with towing), for periods as stated.

Sand-pump Dredge.	Where working.	1 July, 1906, to 30 June, 1907. Dredging, Towing, and Repairing. Tons.	Expenditure. £ s. d.	Pence per ton. d.	1 July, 1907, to 30 June, 1908. Dredging, Towing, and Repairing. Tons.	Expenditure. £ s. d.	Pence per ton. d.	Remarks
"Neptune"	Newcastle	211,450	4,130 5 10	4·69	263,000	2,930 16 1	2·67	
"Juno"	Newcastle	64,500	5,172 15 3	19·25	205,000	2,862 4 5	3·35	
"Jupiter"	Newcastle	269,500	4,898 3 3	4·36	360,000	6,876 14 2	4·58	
"Castor"	Newcastle	622,721	6,538 15 1	2·52	625,101	5,900 19 10	2·27	
"Actor"	Tweed River	71,299	4,013 14 10	13·51	253,508	2,169 12 10	2·05	
"Alesus"	Richmond River	69,769	3,984 1 2	13·70	64,766	4,550 8 2	16·86	
"Dorus"	Manning River	29,607	2,123 9 4	17·57	121,783	2,556 4 1	5·04	
"Dictys"	Richmond River	32,635	2,887 14 9	21·24	39,018	3,816 0 0	23·47	
"Groper"	Macleay River	144,338	3,801 15 0	6·32	114,299	3,957 16 10	8·31	
"Glaucus"	Newcastle	1,055,500	8,380 12 8	1·91	1,051,000	8,494 9 5	1·94	Indurated sand lifted, 31,412 tons; loose sand lifted, 7,606 tons.
"Antleon"	Cape Hawke, Manning River, Camden Haven, Newcastle, Port Macquarie, Clarence River, Bellinger River, Nambucca River, Shoalhaven, Macleay River	283,500	5,476 8 2	4·64	250,750	5,955 12 5	5·70	1907-8. Camden Haven 47,250 tons, £1,475 9 2, 7·50 d.; Manning River 250 tons, £59 8 10, 57·06 d.; Clarence River 70,250 tons, £1,224 9 3, 4·18 d.; Bellinger River 5,000 tons, £299 14 11, 14·39 d.; Macleay River 1,000 tons, £123 5 11, 29·59 d.; Nambucca River 26,000 tons, £909 12 5, 8·40 d.; Port Macquarie 25,500 tons, £416 8 9, 3·92 d.; Cape Hawke 25,750 tons, £605 15 8, 5·65 d.; Shoalhaven 49,750 tons, £841 7 6, 4·06 d.
"Tethys"	Clarence River, Nambucca River, Bellinger River, Newcastle, Richmond River, Cape Hawke, Manning River, Tweed River, Macleay River	308,410	6,301 16 10	4·90	374,090	5,921 3 5	3·80	1907-8. Newcastle 39,050 tons, £557 7 11, 3·43 d.; Richmond River 131,200 tons, £2,054 17 1, 3·76 d.; Clarence River 87,360 tons, £1,417 2 10, 3·89 d.; Tweed River 44,800 tons, £878 12 2, 4·71 d.; Macleay River 71,680 tons, £1013 3 5, 3·39 d.

Comparative Statement of Quantity and Cost of Work done by Combined Grab and Sand-pump Dredges (with towing), for periods as stated.

Combined Grab and Sand-pump Dredge.	Where working.	1 July, 1906, to 30 June, 1907. Dredging, Towing, and Repairing. Tons.	Expenditure. £ s. d.	Pence per ton. d.	1 July, 1907, to 30 June, 1908. Dredging, Towing, and Repairing. Tons.	Expenditure. £ s. d.	Pence per ton. d.	Remarks.
"Delta"	Lake Macquarie, Myall River	148,780	2,256 18 7	3·64	125,520	2,178 4 8	4·16	1907-8. Lake Macquarie 6,800 tons, £490 9 4, 17·31 d.; Myall River 118,720 tons, £1,687 15 4, 3·41 d.
"Eta"	Moruya River, Wagonga River	120,190	1 840 18 3	3 68	148,464	1,655 3 9	2·68	Moruya River 73,200 tons, £1,010 16 5, 3·37 d.; Wagonga River 75,264 tons, £644 7 4, 2·05 d.
"Theta"	Camden Haven	137.035	1,575 0 3	2·76	142,160	1,661 2 4	2·80	
"Sigma"	Tweed River	46,993	1,723 11 1	8·80	67,150	1,673 11 6	5·97	
"Rho"	Bellinger River	63,785	1,756 17 10	6·61	80,317	1,670 12 3	4·99	

Comparative Statement of Quantity and Cost of Work done by Grab Dredges (with towing), for periods as stated.

Grab Dredge.	Where working.	1 July, 1906, to 30 June, 1907. Dredging, Towing, and Repairing. Tons.	Expenditure.	Pence per ton.	1 July, 1907, to 30 June, 1908. Dredging, Towing, and Repairing. Tons.	Expenditure.	Pence per ton.	Remarks.
			£ s. d.	d.		£ s. d.	d.	
"Beta"	Bellinger River / Myall River	560	282 11 10	121·11	32,619	1,351 12 8	9·94	Myall River, all 1807–8.
"Iota"	Nambucca River	10,046	86 15 11	2·07	9,092	429 11 11	11·34	
"Kappa"	Shoalhaven / Kiama / Wollongong / Port Hacking / Cook's River	19,925	1,538 13 10	18·53	.....	.....	.....	Working at Wolli Creek Improvements 1907–8. Details not included herein.
"Mu"	Richmond River	29,793	687 16 10	5·54	23 540	1,111 14 5	11 33	
"Nu"	Newcastle	23,670	2,071 13 0	24·01	38,000	1,888 19 11	11 93	
"Upsilon"	Newcastle	34,035	1,619 3 4	11·42	57 215	2,002 5 7	8 40	
"Omega"	Clarence River	9,668	409 5 2	10·16	19,850	252 11 1	3·05	
"No. 52"	Richmond River	.....	.....	.....	14,710	649 8 0	10·59	

Average Cost of Dredging and Towing, for periods as stated.

Class of Dredge.	1 July, 1906, to 30 June, 1907. Tons dredged.	Hours dredging.	Dredging only. Expenditure.	Average cost per ton.	Average cost per hour.	Dredging and Towing. Expenditure.	Average cost per ton.	1 July, 1907, to 30 June, 1908. Tons dredged.	Hours dredging.	Dredging only. Expenditure.	Average cost per hour.	Average cost per ton.	Dredging and Towing. Expenditure.	Average cost per ton.
			£ s. d.	d.	£ s. d.	£ s. d.	d.			£ s. d.	£ s. d.	d.	£ s. d.	d.
Ladder	1,424,641	8,596	18,576 17 1	3·13	2 3 3	25,728 15 9	4·33	1,412,213	9,246	15,382 19 1	1 13 3	2·61	21,446 12 4	3·64
Sand-pump	3,162,629	8,736	51,910 10 0	3·94	5 18 10	57,709 12 2	4·38	3,722,315	11,976	50,509 11 10	4 4 4	3·26	55,992 1 8	3·61
Combined Grab and Sand-pump	647,566	9,332	10,932 11 5	4·05	1 3 5	11,218 3 2	4·16	763,130	10,551	12,178 10 10	1 3 1	3·83	12,627 18 4	3·98
Grab	127,697	9,600	5,681 8 10	10·68	0 11 10	6,695 19 11	12·58	195,026	12,344	6,462 14 7	0 10 6	7·95	7,686 3 7	9·45
	5,362,533	36,264	87,101 7 4	3·90	2 8 0	101,352 11 0	4·54	6,092,684	44,117	84,533 16 4	1 18 4	3·31	97,752 15 11	3·85

Railway and Tramway Construction Branch.

Report of the Chief Engineer for Railways and Tramway Construction.

Sir, 24 September, 1908.

I have the honor to report as follows on the work carried out in the Railway and Tramway Construction Branch during the year ended 30th June, 1908.

The following railway lines are in progress of construction :—

Manilla to Barraba.—This line commences at Manilla, 211 miles 31 chains from Newcastle, and terminates at 243 miles 36 chains, being a length of 32 miles 5 chains.

A contract was let on the 6th December, 1905, for the construction of the railway. The amount of tender is £87,768 11s. 8d., and the expenditure to the 30th June, 1908, is £78,815 14s. 7d.

On the 9th October, 1907, a tender for the erection of station buildings at Wimborne, Upper Manilla, Black Springs, and Barraba was accepted; the amount is £5,167.

Trucking yards are provided at Upper Manilla and Barraba. A water supply for locomotives is being erected at the latter place.

Sixty-pound flanged rails, 30 feet long, are being used, laid on round-topped sleepers, 2,464 to the mile.

Earth ballast is used throughout, except at bridge ends and station yards, where stone ballast is used. The ruling grade is 1 in 50. Sharpest curve 10 chains radius.

The estimated cost of the line is £134,755, and the total expenditure to the 30th June, 1908, has been £137,315 0s. 8d., which includes £2,630 4s. 1d. paid for land resumption.

Bogan Gate to Bulbodney.—*First Section, Bogan Gate to Trundle.*—This section of railway from Bogan Gate, at 292 miles 26 chains from Sydney, to Trundle, at 308 miles 23 chains from Sydney, or a length of 16 miles, has been completed and handed over to the Commissioners for Railways on the 6th August, 1907.

Station buildings at Botfield and Trundle have been erected at a cost of £1,003 10s.

The accommodation at Trundle comprises a grain shed at a cost of £466; trucking yards for sheep £55, labour only; an excavated tank, 1,500 cubic yards capacity, £953 6s. 8d.

A tank-stand, cast-iron tank to hold 20,000 gallons, pump and boiler, with pump-house, £487 3s. 11d. (erection only).

Second Section—Trundle to Tullamore.—On the 13th March, 1907, a tender, amounting to £41,488 16s. 10d., was accepted for the construction of this section, length 22 miles 17 chains, ending at 330 miles 33 chains from Sydney.

On the 7th April, 1908, a tender, amounting to £5,474 5s., was accepted for the erection of station buildings at The Troffs, Kadungle, Gobondery, and Tullamore; also grain shed and trucking yards at this place.

The line is laid with 60-lb T rails, 30 feet long on round-topped sleepers, 2,464 to the mile.

Earth ballast is used throughout, excepting at bridge ends and station yards, where stone ballast is used.

The ruling grade is 1 in 80 with, and 1 in 100 against, the load. Sharpest curve, 12 chains radius.

The estimated cost of this section is £137,500, and the total expenditure to 30th June is £109,694 13s. 8d.

Temora to Barellan.—The first section from Temora to Ariah Park was completed and handed over to the Railway Commissioners on the 1st November, 1906.

On the 3rd August, 1906, a tender, amounting to £57,712 17s. 4d., was accepted for the construction of the second section, Ariah Park to Barellan, a length of 41 miles 1½ chains, ending at 352 miles 70½ chains from Sydney. This section was handed over to the Commissioners for Railways on the 15th June, 1908.

On the 14th October, 1907, a tender amounting to £6,998, was accepted for the construction of station buildings at Merrool, Beckom, Ardlethan, Bygoo, Erin, and Barellan, also pump-houses at Beckom and Barellan, trucking yards for sheep at Beckom and Barellan; erection of trucking yards for cattle at Barellan, £566 13s.; excavation of a 30,000 yard tank at Barellan for the supply of water to locomotives, £2,656 13s. 3d.; excavation of a 20,000 cubic yard tank for supply of water to locomotives at Beckom, £1,773 18s. 3d.

At Beckom and Barellan a tank-stand, 20,000 gallon cast-iron tank, pump, and boiler have been provided.

The line is laid with 60-lb. T rails, 30 feet long, on round-topped sleepers, 2,464 to the mile. Earth ballast is used throughout, except at bridge ends and station yards, where stone ballast is used.

The ruling grade is 1 in 100 against the load, and 1 in 80 with the load; sharpest curve, 12 chains radius.

The estimated cost of this extension is £183,927, and the expenditure to 30th June is £173,693 4s. 3d.

Narrabri to Walgett, with a Branch to Collarendabri.—This line commences at West Narrabri, 252 miles 36·75 chains from Newcastle, and terminates near Walgett at 358 miles 22·53 chains.

The branch line to Collarendabri commences at Burren Junction, 304 miles 3 chains from Newcastle, and terminates at Collarendabri East at 346 miles. The total length of the extension is 147 miles 63·78 chains.

The

The works were commenced in March, 1901, and up to the beginning of this financial year the portions from West Narrabri to Cryon on the Walgett line, and from Burren Junction to Collarendabri East were opened for public traffic.

The section between Cryon and Walgett is now in course of construction, and nearing completion. The extension of the railway to the Namoi River at Walgett increased the work very materially, and the floods of March, 1908, made it necessary to largely increase the waterways and raise the embankments, otherwise the railway would have been completed some months ago.

The whole of the above works, excepting station buildings and trucking yards, have been carried out by day-labour.

On the 27th November, 1907, a tender, amounting to £4,760, was accepted for the erection of station buildings at Beanbri, Eurie Eurie and Walgett, and also trucking yards at Beanbri and Walgett, the Department providing a large portion of the materials.

Pump-houses at Walgett and at 333 miles 20 chains, are provided; cost, £33 10s. At 333 miles 20 chains, an excavated tank, 20,000 cubic yard capacity, is provided for the supply of water to locomotives, cost £2,041 14s. 6d.; and also a tank-stand, 20,000 gallon cast-iron tank, pump, and boiler, both at 333 miles 20 chains and Walgett.

The estimated cost of the line, including branch to Collarendabri, is £503,559, and the expenditure to 30th June, 1908, is £401,684 11s. 3d.

Necropolis Extension.—On the 24th October, 1907, a tender, amounting to £3,789 13s 10d., was accepted for an extension of the Necropolis Railway.

This contract commences at the terminus in the Necropolis, at a point 63 chains on the line, and terminates at 1 mile 43 chains, being a total length of 60 chains.

This is a full ballasted line, with 60-lb. steel rails.

The construction of Mortuary Station No. 3, and a septic tank and filter cost, £658 19s. 4d.

This extension was handed over to the Railway Commissioners in the beginning of May, 1908, and opened for public traffic on the 19th June, 1908.

The estimated cost of construction is £5,635, and the total expenditure is £4,830 1s. 9d.

Belmore to Chapel-road.—On the 13th November, 1907, a tender, amounting to £36,559 4s. 6d., was accepted for the construction of an extension of the Belmore Railway. This commences at 8 miles 37 chains 80 links from Sydney, and terminates at 11 miles 69 chains 5·5 links, being a total length of 3 miles 31 chains 25·5 links.

There will be two platforms (Lakemba and Punchbowl), and a terminal station at Bankstown (Chapel-road), all with island platforms.

The line is laid with 80-lb. silicon flanged rails, 40 feet long, on squared sleepers, 9 feet by 10 inches by 5 inches, 2,012 to the mile.

The ruling grade is 1 in 90 with, and 1 in 100 against, the load; sharpest curve, 20 chains radius.

The estimated cost of this extension is £42,183, and the expenditure to end of financial year is £23,866 16s. 2d.

Mudgee to Dunedoo.—*First Section, Mudgee to Gulgong.*—This line commences at the west end of the Mudgee railway station, at a point 189 miles 22 chains 52·68 links from Sydney, and terminates at Gulgong, at 209 miles 41 chains 81·8 links from Sydney, being a total length of 20 miles 19 chains 29·12 links.

A contract was let on the 27th November, 1907, amounting to £41,704 13s. 4d.

The earthworks are practically completed, and the bridge work is following up.

Second Section, Gulgong to Dunedoo.—The survey is finished, and plans and specification are being prepared.

The estimated cost of the whole line is £175,989, and the total expenditure up to the 30th June, 1908, is £32,276 8s. 9d.

North Coast Railway—West Maitland to Grafton.—This line commences at 20 miles 23 chains from Newcastle, on the Northern Railway, about half a mile north of the West Maitland railway station, and ends on the southern bank of the Clarence River at South Grafton. The length of the railway between West Maitland and South Grafton will be about 310 miles 58 chains.

On the 13th November, 1907, a tender was accepted for the supply, manufacture, and delivery, on steamer or railway trucks, of the steel work for the bridges over the Hunter and Paterson Rivers. The Hunter River bridge will consist of three 157 ft. 6 in. truss spans, and six 32 feet plate girder spans, all supported by concrete piers or steel trestle piers. The bridge over the Paterson River will consist of one 200 feet steel truss span, and two plate girder spans of 66 ft. 4 in. The amount of the tender for the two bridges is £15,050.

On the 28th April, 1908, a tender, amounting to £298,235 15s., was accepted for the construction of the first part to Dungog, length 32 miles 65·60 chains. This will be a first-class single line of railway, fully ballasted, and laid with 80-lb. silicon rails.

On the 30th April, 1908, a tender for the supply, manufacture, and delivery, on trucks or steamer, of steel bridges at West Maitland, Oakhampton Swamp, Wallarobba and Tabbil Creeks, was accepted. The amount is £2,249.

The ruling grade is 1 in 80; the sharpest curve 12 chains radius.

The estimated cost between West Maitland and Grafton is £2,650,820, and the expenditure to the 30th June, 1908, is about £7,888.

The following railways have been authorised by Parliament during the year, viz.:—Lockhart to Clear Hills, 50 miles, estimated to cost £149,681; and Narromine to Peak Hill, 36 miles, estimated to cost £121,317.

Explorations have been made, and reports (each accompanied by a diagram plan) have been submitted in connection with the following projected railways during the year:—Albion Park to Robertson; Forbes to Grenfell, *viâ* Piney Range; Forbes to Stockinbingal; Hermidale to Nymagee; Manilla to Boggabri; Muswellbrook to Cassilis; Nyngan to Cobar, deviation *viâ* Mount Boppy; Tullamore to Orange Plains; Walcha Road to Walcha.

Inspections

Inspections of the following trial and permanent surveys have been made during the year:—Coramba to Dorrigo—Part 2; Cobar to Broken Hill, *viâ* Wilcannia; Condobolin to Broken Hill, *viâ* Menindie; North Coast Railway, portion between Maitland and Taree.

The following lines, whilst under consideration by the Public Works Committee, were inspected in conjunction with the Committee:—Cowra, *viâ* Canowindra, to Gregra, and Kyogle, *viâ* Casino, to Coraki.

Seven trial surveys were in hand during the year, and the field operations of five of them were completed.

The following tables show the aggregate mileages of the field operations carried out by the field staff engaged on trial and permanent surveys during the past year:—

TRIAL SURVEYS.

Preliminary explorations.	Preliminary traverse.	Preliminary levels.	Staking.	Levels.	Check levels.	Cross levels.	Details.	Inspections.
miles chains	miles chains	miles chains	miles chains	miles chains	miles chains	miles chains	miles chains	miles chains
1,033 60	372 70	327 74	251 23	246 23	84 4	401 45	120 12	535 00

PERMANENT SURVEYS.

Staking.	Levels.	Check levels.	Cross levels.	Details.
miles chains	miles chains	miles chains	miles chains	miles chains
84 71	84 71	95 11	162 62	294 9

TRAMWAY CONSTRUCTION.

Estimates were prepared and preliminary investigations made for the following tramway extensions:—Crown-street, *viâ* Baptist-street, to Phillip-street; Elizabeth-street, avoiding Fitzroy-street, to Moore Park; Norton-street, Leichhardt, to Ashfield; Parramatta and Liverpool Roads Junction to Strathfield, *viâ* Parramatta-road; Arncliffe to Bexley, *viâ* Wollongong-road; Broken Hill extension—Beryl-street to the Oval; Broken Hill extension—Argent-street to McLeod's Store; Lillie Bridge to Balmain-road—Part 2; Spit to Manly; Balmoral Beach, *viâ* Gordon and Raglan streets; Broadmeadow to Waratah; Marrickville to Undercliffe; Undercliffe to Junction of William and Homer streets; Waverley to Bronte; Redhead to Belmont; Belmont to Swansea; Walker-street, *viâ* Mount-street, to Miller-street; Walker-street, *viâ* Berry-street, to Miller-street; Falcon-street to Suspension Bridge; Miller-street to M'Mahon's Point; Balmoral Beach, *viâ* Gordon and Mulbring streets; Sutherland to Cronulla Beach, *via* Malvern-road; Waverley to Bronte, *viâ* Lugar-street; Military-road to Cremorne; Broken Hill—Beryl-street to Rakow-street; Lillie Bridge to Balmain—Part 2, terminating at Catherine-street; Sans Souci to Cronulla Beach; Kogarah to Cronulla Beach; Windsor to Sackville Reach; Lillie Bridge to Balmain—Part 2, terminating at Piper-street; Spit to Manly, *viâ* Lauderdale-avenue; Broadmeadow to Waratah West, side of Show Ground; Cronulla to Kurnell Wharf.

Plans and estimates were prepared for the following proposals for submission to the Parliamentary Standing Committee on Public Works:—Spit to Manly; Sutherland to Cronulla Beach; Dulwich Hill to Ashfield.

Approval has been given by Parliament for the construction of the following tramway extensions:—Drummoyne to Hatton's Flat, Ryde; Wallsend to West Wallsend.

Ministerial authority has been given for the construction of the undermentioned tramways:—Gore Hill to Burns' Bay-road; Willoughby to Chatswood; Arncliffe to Bexley; Falcon-street to Suspension Bridge, North Sydney; Junction-street, *viâ* Walker-street, to Miller-street; Miller-street to McMahon's Point; Miller-street to Crow's Nest; Lillie Bridge to Balmain—Part 2; Crown-street and Baptist-street to Phillip-street; Castlereagh-street, *viâ* Cleveland-street, to Newtown-road; Henderson-road, Alexandria; Manly to Brookvale; Ultimo Depôt to George-street.

The following tramways, which were authorised last year, have been completed or are under construction:—

Adamstown Junction to the Racecourse, Newcastle.—This is a steam tramway, connecting the Newcastle system with the new racecourse, the length being about 1 mile single track, 60-lb. rail on sleepers. A tender for £2,025 16s. 3d. was accepted on the 14th February, 1907, and the tramway completed and handed over for traffic on the 1st July, 1907. The total cost of this extension amounts to £4,165 18s. 10d., the estimated cost being £3,930.

The ruling grade is 1 in 500, and the sharpest curve is 1½ chains radius.

Concord to Cabarita.—This is a steam tramway, and branches off the Enfield to Mortlake tramway at Cabarita-road, which it follows for a length of 77 chains, terminating in Cabarita Park, the estimated cost being £3,387.

A contract for the construction of the permanent-way was let on the 18th April, 1907; amounting to £1,751 11s. 2d.

On the 31st July, 1907, the tramway was completed and opened for traffic.

The total cost of this extension amounts to £3,949 1s. 3d.

The ruling grade is 1 in 21·4, and the sharpest curve 2 chain radius.

Broken Hill Extension to the Oval.—This tramway is an extension from the existing terminus in Thomas-street to a point opposite the Cricket Oval, a distance of about 36 chains in William-street, the estimated cost being £3,349.

A contract was let on the 10th April, amount £1,760 17s. 10d.

The work was completed and opened for traffic on the 7th September, 1907, the total cost being £2,620 16s. 11d.

Lillie Bridge to Balmain Road—Part I.—This tramway branches off the Forest Lodge to Balmain tramway at the Lillie Bridge Recreation Grounds, thence *viâ* Taylor and Booth streets to Johnstone-street. The distance is 47 chains, the first 24 chains being double track.

The ruling grade is 1 in 16·3, and the sharpest curve 80 feet radius.

The estimated cost of this extension amounts to £15,967, the expenditure to 30th June being £7,623 4s. 3d.

A contract, amounting to £219, was let on the 14th May, 1907, for the construction of a single track bridge to carry the tramway over the Johnstone's Creek storm-water channel. This contract was completed, and the bridge delivered on the 9th December, 1907.

It having been decided to duplicate this portion of the tramway, a contract was let for a second bridge on the 30th May; amount of contract, £220. This bridge was delivered early in November, 1907.

A contract, amounting to £4,545 18s. 2d., for the construction of the permanent-way and overhead wiring was accepted on the 23rd July, and the work was completed and opened for traffic on the 28th January, 1908.

Bellevue Hill Tramway.—This tramway commences at the intersection of Park-street and Elizabeth-street; thence along Yurong, Stanley, Burton, and Macdonald streets, Glenmore-road, Gurner, Hargrave, Moncur, and Queen streets, Edgecliffe-road to Bellevue Hill Reserve, a distance of about 3¾ miles, double track. A tender for the construction of the permanent-way, including Thermit welding, erection of poles and overhead wiring, amounting to £39,096 0s. 6d., was accepted on the 6th April, 1907.

The ruling grade is 1 in 12, and the sharpest curve is 66 feet radius.

Tenders for the manufacture of the Ocean-street junction and three cross-over roads were received on the 17th June, 1907; amount of the contract, £399.

The total estimated cost of this tramway, including power, feeders, and rolling stock, is £125,572. Total expenditure to 30th June, 1908, £102,172 4s. 3d.

Enmore-road, via Addison-road, to Dulwich Hill.—This tramway branches off the Dulwich Hill tramway at the intersection of Enmore-road and Addison-road, thence *viâ* Addison-road, Livingstone-road, and New Canterbury road to the Dulwich Hill terminus, a distance of 2 miles double track.

The ruling grade is 1 in 23·17, and the sharpest curve 80 feet radius.

The estimated cost, including power, feeders, and rolling stock, is £60,856.

A contract for the construction of the permanent-way was accepted on the 27th August, 1907, the amount of the contract being £12,389 12s 6d.

A contract for the erection of the poles and overhead wiring was let on the 13th November; amount, £969 10s.

Total expenditure to 30th June, 1908, £39,346 11s. 6d.

George-street, via new street, to Erskineville.—This tramway branches off the existing Circular Loop near the Devonshire-street subway, crossing the Darling Harbour Railway by an overhead bridge to be built in connection with the opening up of a new street, which will be a continuation of Pitt-street into Regent-street; thence *viâ* Regent, Meagher, Abercrombie, Golden Grove, Wilson, and Burren streets, where the double track ends at Thomas-street, with a length of 1 mile 52 chains, continuing along Burren-street, Erskineville, Septimus and Albert streets back to Thomas-street and Burren-street, forming a single track loop 44 chains in length.

The ruling grade is 1 in 18·62, and the sharpest curve 70 feet radius. The estimated cost of the tramway, including power, feeders, and rolling-stock, is £63,264.

A contract was let on the 27th December, 1907, for works in connection with the new street; the amount of tender is £6,787 17s.

Expenditure to 30th June, 1908, £4,105 11s. 5d.

A tender, £15,208 8s. 8d., for the construction of the permanent-way, was accepted on the 3rd September, 1907; and a contract for the erection of poles and overhead wiring, amounting to £936 9s. 5d. was let on the 11th March, 1908. A contract for the manufacture, supply and delivery of one double turn-out, with diamond crossing, was let on the 6th March, 1908, amount, £459 18s.

The Thermit welding on this tramway is being carried out by day-labour.

Total expenditure to 30th June, 1908, £17,192 16s.

East to West Maitland.—This tramway commences in Victoria-street, East Maitland, thence along that street and Lawes, George, Day, Melbourne, Newcastle, and High streets to Regent-street, a distance of about 3 miles 72 chains, single track. This tramway will be worked by steam traction.

The ruling grade is 1 in 22, and the sharpest curve is 90 feet radius.

The total estimated cost of this tramway is £25,352, exclusive of cost of rolling stock.

A contract for the construction of the permanent way, amounting to £10,982, was let on the 19th July, 1907, and at the close of the year was almost completed.

A contract for the construction of a viaduct alongside the Long Bridge, West Maitland, was let on the 19th November, 1907, the amount being £2,287 7s.

A contract for the erection of the motor and car sheds at East Maitland was let on the 23rd March, 1908, the amount being £1,650.

A contract for the construction of the permanent-way, &c., in connection with the terminal loop and sidings at East Maitland, was let on the 19th March, the amount being £1,516 14s. 10d.

Total expenditure to 30th June, 1908, £15,642 18s. 8d.

Watson's Bay Extension through Gap Park to Clovelly.—This is an extension of the existing tramway through Gap Park, terminating near Clovelly Park, a distance of about 65 chains single track.

The steepest grade is 1 in 12, and the sharpest curve 80 feet radius.

The estimated cost, including power, feeders, and rolling stock, is £13,635.

A contract for the construction of the permanent-way was let on the 8th October, 1907, the amount of contract being £4,002 16s. 6d. On the 11th June a contract, amounting to £933 10s., was let for the erection of the poles and overhead wiring. On the 21st May a contract was let for the erection of a waiting-shed in Clovelly Park, the amount of the tender being £69 17s. 6d.

Total expenditure to 30th June, 1908, £8,464 18s. 7d.

Queen-street,

Queen-street, via Ocean-street, to Waverley Car-house.—This extension, 13 chains in length, double track, will connect the Bellevue Hill tramway with the Waverley car-house, and will be used for the transfer of rolling stock.

The Ocean-street junction has been laid in, and plans are ready for the remaining portion of the work.

Willoughby to Chatswood.—This tramway commences at the terminus of the Willoughby tramway in Penshurst-street, and runs thence along Victoria-avenue, terminating at Chatswood Railway Station, a distance of 77 chains single track.

The estimated cost is £9,712.

The ruling grade is 1 in 19·88, and the sharpest curve 70 feet radius.

On the 21st February, 1908, a contract was let for the construction of permanent-way, Thermit welding, and overhead wiring, the amount of the contract being £4,166 10s.

Total expenditure to 30th June, 1908, £4,917 2s. 3d.

Surveys are in hand, or have been completed during the year, in connection with the following tramways authorised :—Gore Hill to Burns' Bay road ; Willoughby to Chatswood ; Arncliffe to Bexley ; Falcon-street to the Suspension Bridge, North Sydney ; Junction-street, *viâ* Walker-street, to Miller-street ; Miller-street to McMahon's Point ; Miller-street to Crow's Nest ; Lillie Bridge to Balmain—Part 2 ; Crown-street and Baptist-street to Phillip-street ; Castlereagh-street, *viâ* Cleveland-street, to Newtown-road ; Henderson-road, Alexandria ; Drummoyne to Hatton's Flat ; Wallsend to West Wallsend.

Plans and specifications are in course of preparation for the following tramways authorised. Tenders will be invited for several of these at an early date :—Gore Hill to Burns' Bay road ; Arncliffe to Bexley ; Falcon-street to Suspension Bridge, North Sydney ; Johnstone-street, *viâ* Walker-street, to Miller-street ; Miller-street to McMahon's Point ; Miller-street to Crow's Nest ; Lillie Bridge to Balmain—Part 2 ; Crown-street and Baptist-street to Phillip-street ; Castlereagh-street, *viâ* Cleveland-street, to Newtown-road.

The construction of tramways has been particularly brisk during the year, and the mileage under construction has far exceeded that of any previous year, the extension of these tramways being absolutely necessary to cope with the increase in population and consequent development of traffic.

In nearly all cases the rails are Thermit welded at the joints by Dr. Goldschmidt's process, the exception being on sharp curves, where ordinary copper bonds are used owing to the rapid wear of the rails, and where it would not pay to use the Thermit weld.

The staff employed on Railway and Tramway Construction Work consists of 1 Principal Assistant Engineer, 13 Assistant Engineers, 13 Surveyors, 25 Engineering Draftsmen, 28 Survey Draftsmen, and 24 Inspectors. To all these officers I desire to express my cordial appreciation for the very able and loyal service they have at all times rendered to me.

WM. HUTCHINSON,

Under Secretary. Chief Engineer, Railway and Tramway Construction.

Report of the Government Architect for the Year ending 30th June, 1908.

I HAVE the honor to submit the Annual Report of this Branch for the year ending 30th June, 1908.

The past year has been one of continued and continuous activity, and in addition to the duties rendered and the services involved in actual expenditure, a large amount of professional work has been done in anticipation of future operations and to meet passing requirements.

The expenditure for the year (as compared with that of the three previous years) is shown in the following statement prepared by the Departmental Accountant:—

	1904-5.	1905-6.	1906-7.	1907-8.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Loans	50,614 8 1	41,189 13 2	32,743 8 5	94,024 4 0
Consolidated Revenue ...	45,692 11 1	57,962 9 11	33,322 7 3	34,644 0 11
Special Deposits	.....	26,080 18 1	15,252 14 6	7,633 9 6
Treasury Advance ...	.....	.....	.....	279 1 11
Federal Works	41,080 12 2	29,723 8 6	23,450 8 9	29,596 3 4
Other Departments ...	19,790 0 0	54,858 11 5	57,022 5 2	48,238 16 6
Schools Buildings ...	25,948 11 9	51,500 0 0	61,289 11 1	80,257 11 6
Imperial Naval Authorities	3,455 1 9	22,672 16 1	12,237 11 5	836 8 8
Norfolk Island Administration	80 0 0	1,720 0 0	43 6 3	43 2 11
Resumed Properties ...	7,359 13 5	7,193 3 5	7,539 13 1	14,012 15 3
Public Works Fund ...	.....	.....	76,826 11 8	199,507 6 6
Challis House—University Senate	.....	.....	31,000 0 0	.....
Totals	£194,021 18 3	£292,901 0 7	£350,727 17 7	£509,073 1 0

The general prosperity of the State and its enterprise in meeting growing requirements is reflected in the above statement.

While a large number of improvements to existing buildings, and the erection of new ones has taken place, the record of completed new buildings for the year does not happen to be an extensive one.

Notes as to several of the more important ones dealt with are here recorded:—

Mitchell Library.—The erection of this portion of the new National Library has been completed, and was taken possession of by the Trustees on the 1st March. The books comprising the Mitchell Bequest have been placed in temporary shelves until the permanent bookcase and fittings have been supplied. A contract has been entered into for the completion of the bookstack. Towards the end of the year tenders were invited for the completion of the whole design.

Royal Naval House.—The extensive additions to the Royal Naval House have been completed, and the new wing was opened by His Excellency Sir Richard Poore, Bart., C.V.O., on Empire Day, 24th May.

Hospitals for the Insane.—The new wards in connection with the Reception House, Darlinghurst, and the female wing at Callan Park, have been completed and handed over for occupation.

The erection of new admission blocks at Kenmore and Gladesville Hospitals is progressing favourably, and will shortly be completed.

A contract has been let for the erection of the first pavilion of the new institution at Morisset, and plans are being prepared for the erection of the recreation block and the Medical Superintendent's residence.

Plans are being prepared for the new Matron's and Nurses' Quarters, extensive additions to Kitchen Block and the Administrative Block, Gladesville Hospital, and for new Admission Block and Hospital Block for the Parramatta institution.

Parliamentary Buildings.—Important improvements have been completed at the Parliamentary Buildings during the year, consisting of the erection of new Committee Block and Premier's Offices and Rooms, new Record Room and Quarters for the Librarian and Chief Steward.

Plans are being prepared for remodelling the Council Chamber and Offices and Rooms in connection therewith, and rebuilding the Macquarie-street front.

Police Barracks, Redfern.—These extensive buildings, for the accommodation, principally, of the Mounted Police, were completed during the year, and have been taken possession of by the Inspector-General of Police.

Penitentiary and Female Prison, Long Bay.—As it has now been decided by the Prisons Department to depart from the original intention of completing the buildings in the Female Prison and the Penitentiary by prison labour, contracts have been entered into for the erection of No. 3 Workshop Block and the Matron's Quarters, and plans are being prepared with the view of inviting tenders for the completion of the buildings, both in connection with the Female Prison and the Penitentiary.

Fire Stations.—Contracts have been let for the erection of Fire Stations at the following localities:—Alexandria, Auburn, Penrith, Waterloo, Canterbury, Randwick, Liverpool, and Kogarah. *New*

New Abattoirs.—The construction of the branch railway line from the main suburban trunk line through the Abattoir buildings is being carried out by the Railway Commissioners; and, in addition to this work, they have also undertaken the levelling of the site and forming the roadways.

The plans for the various buildings, which have entailed a considerable amount of labour, are nearing completion, and tenders will be invited as soon as the railway line is completed and ready for delivery of the materials to the site.

Rookwood Asylum.—Erection of Medical Officers' Quarters and new Hospital Block and Morgue.

George-street Asylum, Parramatta.—Erection of new Dining Hall.

Newington Asylum.—Erection of new Laundry Building.

Hawkesbury Agricultural College.—Erection of new Servants' Quarters, Boiler House, and Orchardist's Cottage.

Watson's Bay.—Erection of new Shed for Life Boat.

Challis House.—Completion of this important building, in conjunction with Messrs. Robertson and Marks, when, by arrangement, the State became tenant only of premises for Railway Commissioners and Intelligence and Tourist Bureau Departments.

Waterfall Hospital for Consumptives.—This extensive building made considerable progress during the year, and arrangements were also made to proceed with temporary administrative buildings.

University of Sydney—Fisher Library.—Satisfactory progress was made, and important contract for the construction of cedar and copper roofs, book stack fittings, and general furnishings were entered into.

Russell Engineering School.—This extensive building was completed and handed over and occupied by the University Authorities.

Russell Engineering Workshop.—A contract was entered into for the erection of extensive workshops adjoining the Engineering School.

Medical School.—Arrangements were made for entering into a contract for the erection of extensive additions to this building.

Darlinghurst Court-house.—New accommodation for the Federal High Court.

New Court Houses and Police Buildings have been erected at Albion Park and Hunter's Hill; and new Police Buildings at Annandale and Emu Plains.

Art Gallery.—A contract was entered into and proceeded with for the erection of New North-west Façade and Gallery behind.

Australian Museum.—A contract was entered into and good progress made with a new wing to this building.

Commonwealth Ordnance Stores, Darling Island.—A contract entered into for pile-driving and foundations for future buildings.

New Post Offices.—At Bondi and Canterbury; and new Telephone Exchange Buildings, at Edgecliff, Newtown, North Sydney, Waverley, and William-street.

Coroner's Court.—This building, costing £4,235, has been completed, and having been erected in close contiguity to the Morgue (erected last year), Sydney now possesses a complete establishment with the most modern appliances and fittings.

Observatory Hill Resumption.—Thirty-two model dwelling houses, Windmill-street, erected at a cost of £13,579, were completed and at once occupied at satisfactory rentals.

Nine dwelling houses, Upper Fort-street, erected at a cost of £8,035, were completed and also let at satisfactory rentals.

Eight shops, George-street: Contract let and work in progress.

New Mines Museum.—Arrangements to enter into a contract were made for completing the buildings in Lower George street originally designed as a Power House, and adopting it as the permanent home of the Mines and Forestry Museum and Laboratories, enabling the temporary Technological Museum Buildings in the Domain to be at last removed.

School Buildings.—The recent development of modern system of School training, and the fact that the existing accommodation throughout the State was quite overtaxed, and had in fact become obsolete in its arrangements, have involved heavy work upon the Branch.

The officer in charge of the Schools of the Metropolitan District reports:—"All the new school buildings erected this year, or in course of erection, demonstrate developments in the modern separate classroom system, which have entirely superseded the obsolete long school-room plan with its impossible lighting and other defects. A special arrangement in many cases has been made to enable two classrooms to be thrown into one by the introduction of accordion or folding partitions between them. This provision is necessary to provide for efficient control of two classes simultaneously in the event of an unexpected shortage of teachers through illness, or otherwise. In all cases of new buildings, the lighting is arranged to fall over the left shoulders of the children, and clear glass has been substituted for coloured to all the classroom windows. Many other details have received attention, such as steel reinforced concrete stairs and upper floors, improved ingress and egress, the making of doors to open outwards in lieu of inwards, as formerly, the reducing of internal wood finishings to a minimum to do away with lodgments for dust, and the appropriate colouring of the interiors."

About £46,000 has been expended during the past year on school and college buildings in the metropolitan area alone, which includes:—Erection of new School Buildings at Arncliffe, Tempe, Drummoyne, Cobbitty; and extensions at Bondi, Kogarah, Technical College, Nowra and Paddington.

In the country districts new Court Houses have been erected at Kyogle, Mullumbimby, and Aberdare; new Police Buildings at Bathurst, Bimbi, Raymond Terrace, Curlewis, Attunga, Boggabilla, Pallamallawa, Somerton, and Cobar; new School Buildings at Lithgow, Greghamstown, Broken Hill (Central), Broken Hill (Burke Ward), Wallendbeen, Howlong, South Goulburn, Dorroughby Grass, Tweed Heads

Heads, Tintinbar, Cessnock, West Maitland, Waratah, Kurri Kurri, Parkes, Manildra, and Bective; new Post Offices at Manilla, Culcairn, Kyogle, Bangalow, Curlewis, and Cobar; alterations to Court House have been carried out at Cowra; additions have been made to the School Buildings at Gilgai and Milltown, and Newcastle Hospital; extensions have been made to the School Buildings at Cooma, Gundagai, South Gundagai, Yass, Woolgoolga, Alumny Creek, Grafton, Weston and Muswellbrook; residence has been erected at Cowra Experimental Farm, Savings Bank at Broken Hill, Pilot Station at Moruya Heads, Pilot's Cottage at Newcastle; new wing at Jenolan Caves; erection of the Hotel at Kosciusko; and a new Drill Hall at Casino. The Creel at Thredbo has been completed.

Light Houses.—As in previous years, the Annual Inspection of Light Houses and Pilot Stations was made, and a complete report indicating all building requirements was submitted to the Department of Navigation, and the works so reported upon have been carried out as authorised.

Tramway and Railway Resumptions.—The Branch has been called upon during the year to render professional assistance in determining the values of buildings, on lands resumed, and for which compensation has to be paid. In addition to special ones with which the Government Architect has dealt with personally and in conjunction with the Land Valuer, fifty-eight other valuations involving an amount of £21,473 have also been made and reported upon.

Transferred Properties.—This lengthy and intricate negotiation as between the Federal and the State Governments relative to the value of properties that become automatically transferred under the Constitution Act has been the subject of continuous attention throughout the year, and still remains in an incomplete state.

Very many questions of State and Federal policy were found to be involved when dealing with individual properties, and it has been found necessary to obtain authoritative rulings to guide further action. There has also been considerable delay in other States probably from the same causes. It is hoped that reasonably early in the coming year the valuers may be able to make a final report and recommendation.

The Licensing of Theatres, Public Halls, etc.—For several years past this Branch (the Principal Assistant Architect having given much personal attention) has rendered considerable service in its recommendation to the Theatres Board (appointed under the Chief Secretary's Department), and notwithstanding its vague and unspecified powers, and the defective legislation under which it has been acting, a very important transformation in the construction of the theatres of the State and of the public halls in which stage plays can only be acted under license has been effected, but notwithstanding many inherent defects, particularly in the metropolitan theatre buildings which can only be modified and not altogether remedied, the public safety has been very materially safeguarded.

The want of efficient and modern legislation dealing with all buildings in which the public congregate—no matter for what purpose—is now to be met, and the Hon. the Chief Secretary has prepared a comprehensive measure dealing with this subject, and providing for a continuance of the present constituted Board of Experts, and which it is anticipated will receive the sanction of Parliament during the coming session.

There are about 400 of such buildings in the State, of which the following have been specially inspected and reported upon, and dealt with during the current year:—

Schools of Arts at Jerseyville, Hillgrove, Mullumbimby, Bellingen, Humula, Mitchell Island, East Hills, Bega, Goolmangar, Lower Bucca, Windsor, Epping, Bowraville Wee Waa, Deepwater, Eden, Eastwood, Teralba, Bathurst, Jamberoo, Bellbrook, Cathcart, Morisset, Carrington, Casino and Lawrence; Mechanics' Institute at Albury and Literary Institute at Batlow; Public Halls at Brungle (McGruer's Hall), Newcastle (Masonic Hall and New Oddfellows' Hall) Wingello, (Coronation Hall), Albury (Federal Hall), Mumbil (Mrs. Forest's Hall), Enmore road (Oddfellows' Hall), Newbridge (Trades Hall), Nana Glen (Pioneer Hall), Ulmarra (Masonic Hall), Crow's Nest, Appin (Assembly Hall), Willoughby, Glebe, Gundagai (St. Stanislaus' Hall), Ashfield, Parkes (West's New Hall), Springdale (Corbey's Hall), Woodstock (Marshall's Hall), Kurri Kurri (Lewis' Hall), Berrima (Parish Hall), Guyra (Oddfellows' Hall) Ulmarra (Gaiety Hall), Coraki (Bridge road Hall), Abermaine (Kinleyside's Hall), Murrumbidgee (Garling's Hall), Adamstown (Carrington Hall), Goulburn (Manchester Unity Hall), Portland, Langley Vale, Wallsend (Agricultural Hall), Camden (Royal Foresters' Hall), Albury (St. Patrick's Hall), East Kangaloon, Bungonia, Bathurst (Masonic Hall), Murwillumbah (Skinner's Hall), Southgate (Barrell's Hall), Quipolly (Gros' Hall), Emmaville (Coughlan's Hall), Cessnock and St. George's Hall, Newtown, Theatres at Wonderland City, Open Air Theatre, Sydney; Royal Standard Theatre, Sydney; Tivoli Theatre, Sydney; Theatre Royal, Sydney; Prince of Wales Theatre, Gulgong; Criterion Theatre, Sydney; Palace Theatre, Sydney; Skating Rink, Lithgow; Adelphi Skating Rink, West Maitland; Broken Hill Hippodrome, Buckjumping Show, Prince Alfred Park; Sydney National Amphitheatre; Newtown (Cole's Hippodrome); Railway Institute, Sydney; Report on Ordinances and Regulations; Theatrical Licenses generally; Crown Solicitor's ruling; Draft Theatres and Public Halls Bill for Report, &c.; Halls for Public Entertainments—Report on General Conditions, West Australian Government: Report on Fire-resisting Curtains for.

Scaffolding and Lifts Act.—The following is the report of the Chief Inspector of Lifts and Scaffolding covering the work of the year, and indicating that considerable progress has been made in the interests of public safety:—

The number of notices received, stating intention to erect scaffolding, was 1,157. This does not indicate the actual number of scaffoldings erected, or that have come under the supervision of the inspectors, as a considerable number do not come within the statutory definition of "Scaffolding," which definition comprises only such structures that are built up or fixed to a height of 8 feet from the horizontal base. But under the definition 'gear' all scaffolding where located is subjected to the closest scrutiny on the part of the inspectors. On the average the two officers appointed to these duties effect fifteen to twenty inspections per day each.

An effective check upon building operations is still maintained by the regular receipt of the building notices forwarded by the Metropolitan Board of Water Supply and Sewerage and the Municipal Council of Sydney.

In

In the city, building operations have been particularly extensive, and a great amount of difficult work has been carried out in increasing the height of existing buildings. This latter work invariably requires gear and scaffolding of a complex character, and it is noted with satisfaction that upon this class of work no casualties to the public or employees have occurred.

In connection with building operations generally, there have been recorded eighteen casualties and four fatalities, not one of which could be traceable to defective scaffolding or gear. Three of the fatalities occurred through falls from roofs, and in the remaining case the unfortunate deceased inadvertently stepped backwards down a hoisting well.

The number of cranes and hoisting engines erected and used in the Metropolitan District is :— Hand cranes, 100 ; steam cranes, 22 ; electric cranes, 4 ; steam hoists, 36 ; electric hoists, 8.

In the Metropolitan District ninety-four new lifts were erected. Specifically they are as follows :— Electric lifts, 52 ; hydraulic lifts, 33 ; belt-driven lifts, 9.

The number of lifts in commission to date are :—Electric lifts, 224 ; hydraulic lifts, 679 ; belt-driven lifts, 50.

There occurred two fatalities and several casualties in connection with lifts, due to the careless and indiscriminate method adopted in operating these machines.

No fatalities or casualties are reported in connection with the operations of the Act in the Newcastle district, and the Inspector there reports that, generally, the provisions of the Act are conformed to.

The number of lifts in the district totals 21, and notifications have been received covering the erection of 5 electric lifts.

During the year new regulations were proclaimed under the "Scaffolding and Lifts Act, 1902," providing for the use of iron or steel scaffolding for bricklayers or plasterers, iron or steel fastenings for scaffolding, and approved brackets of the same materials for plasterers, tuck-pointers, &c.

An amending Bill has been drafted, the main features of which are to provide for none but certificated attendants being in charge of passenger-lifts ; supervision of goods-lift attendants ; the certification of persons in charge of power cranes and hoists used for any purpose, and for the direct observance of the Regulations.

Electrical and Engineering Works.—The installation of electrical power with its varied appliances, and—of heating, warming, and cooking plants—steam and hydraulic motor-power, and irrigating and pumping plants—is gradually increasing in numbers and capacity, proportionately as the buildings and institutions, the property of the Government, are also increasing.

Without particularising any of these, excepting the installation of new and extensive laundry plants at some of the hospitals for insane, and benevolent institutions, the staff of officers has been fully engaged during the year, and it is becoming evident that the time has arrived for securing the services of a well-qualified engineer to apply himself exclusively to the electrical installations, and so relieve the present staff. A recommendation has accordingly been made.

District Works Offices.—There are twenty of these offices in the various parts of the State, at which well-qualified officers and their assistants are stationed in order to promptly deal with the very numerous and various instructions issued from the Head Office, and which have been so materially increased since Federal and State school works were placed in the hands of the branch to carry out.

The Assistant Architect in charge reports :—

As the re-arrangement of the districts in question only took place in the early part of 1907, the present report (being to the end of the financial year) is the first occasion in which a review of the working of the country districts, as at present constituted, has been possible. An examination of the facts as herein presented, will show that during the year a very busy time has been experienced, and although the District Works Officers and staffs have been working at high pressure, the volume of work carried through, and the manner in which it has been performed, cannot but be considered as highly satisfactory, and reflecting credit upon the general competency of the officers concerned.

Papers.—The registers of the several district officers show that the number of papers recorded during the year amount to 13,000. The number for which each office was responsible is :—Armidale, 1,120 ; Bathurst, 1,037 ; Cooma, 610 ; Cootamundra, 1,281 ; Dubbo, 501 ; Goulburn, 1,202 ; Kempsey, 270 ; Lismore, 741 ; Narrandera, 332 ; Newcastle, 3,896 ; Parkes, 602 ; Tamworth, 888 ; Bourke, 98 ; Broken Hill, 174 ; Cobar, 147 ; Cudgellico, 8 ; Walgett, 48 ; Wentworth, 33. Total, 12,988.

The following are the details of inspections made, estimates prepared, plans, specifications and copies thereof in connection with the work of the several district offices :—

District.	Inspections.	Estimates.	Plans.	Specifications.
Armidale	170	69	208	202
Bathurst	222	151	300	564
Cooma	167	62	105	148
Cootamundra	250	92	140	225
Dubbo	510	272	59	120
Goulburn	400	100	180	369
Kempsey	168	54	83	113
Lismore	480	82	94	79
Narrandera	99	66	23	26
Newcastle	920	460	393	830
Parkes	103	56	147	31
Tamworth	...	165	139	209
Broken Hill	15	14	2	11
Cobar	62	...	8	12
Cudgellico	1	...	...	...
Walgett	30	...	...	...
Wilcannia	...	...	...	...
Wentworth	21	8	...	3
	3,618	1,631	2,681	3,221

Tenders.—During the year 1,186 tenders have been accepted for works in connection with the districts.

The number of vouchers passed during the year was 5,117, representing an expenditure of £143,468 2s.

I attach hereto a statement showing the amount of travelling done by each of the District Works Officers.

District.	Officer.	Miles travelled by Road.	Miles travelled by Rail.
Armidale	D.W.O.	1,470	4,919
	Asst.	.....	4,614
Bathurst	D.W.O.	2,834	16,991
	Asst.	2,008	11,420
Cootamundra	D.W.O.	1,380	4,428
Cooma	D.W.O.	3,448	.....
	Asst.	3,098	.....
Dubbo	D.W.O.	4,571	4,419
	Asst.	1,090	6,183
Goulburn	D.W.O.	1,761	4,852
	Asst.	2,256	2,688
	do.	432	.. ...
Kempsey	D.W.O.	5,069	59
	Asst.	4,602	.....
Lismore	D.W.O.	2,639	4,938
	Asst.	1,330	1,700
Newcastle	D.W.O.	2,878	6,887
	Asst.	4,609	4,348
Narrandera	D.W.O.	2,885	4,712
Parkes	D.W.O.	1,713	2,600
	Asst.	3,708	2,422
Tamworth	D.W.O.	3,273	8,409
	Asst.	2,995	4,462

Office Returns.—Some idea of the amount of work passing through may be gained from the following office return for the year, including both head and country offices:—

Drawings	7,098
Specifications and duplicates...	8,317
Reports and Estimates	8,731
Contracts entered into	1,894
Number of vouchers issued	10,630

Government Architect's Workshop.—The year's work shows an increase on the number of jobbing works undertaken, the increase being attributable to metropolitan school requisitions. The establishment is in an efficient state, and the superintendent relaxes no effort to keep the wages-sheet within the narrowest possible limits.

Number of works carried out	3,489
Vouchers passed	3,600
Regulations issued	1,873
Dockets issued	9,286
Store Issues	27,858

Total expenditure—£41,558.

In addition to the above, upwards of 1,818 separate jobbing works, at a cost of £7,193, have been carried out by the Resumed Properties Branch.

General.—From various causes, partly the effect of the Federal tariff, the difficulty in obtaining timber and local skilled labour, and partly the generally prosperous condition of the country districts, considerable difficulty has been experienced in obtaining satisfactory tenders (in many cases after two or three invitations) for country works, and the Branch has been much exercised as to how to frame its estimates accordingly. It may be generally assumed that a permanent rise of upwards of 20 per cent. has taken place in building prices, which will remain so long as the local conditions referred to aforesaid also remain.

The Branch is on the best possible business relationships with the Master Builders' Association, and also with the numerous other contractors with whom business is done.

No building disputes of any kind exist in respect to contracts carried out.

I again desire to express my testimony to the willing and able services rendered me by both the Permanent and Temporary staffs throughout the year, and to express the hope that the time has now arrived when the Public Service Board will be able to see its way to a re-casting, in a favourable direction, of many of the salaries of staff officers, now considerably below the value of the services rendered.

Cost of the Branch.—With a view of making a close investigation into the professional cost of carrying out the works of this Branch and ascertaining what percentage the various services have actually cost the Department, a most careful analysis of the work in its various stages and classifications has been compiled, with—I venture to state—a most satisfactory result.

It has been stated that the cost of the work of this Department has varied from 7½ to as high as 20 per cent., calculated on the expenditure. It is difficult, however, to ascertain upon what foundation such statements have been based.

The accountant returns the actual payments on account of building operations for the year at £509,073, while the salary sheet for all officers engaged on this work shows a total of £19,594. A superficial calculation would indicate that the operations should therefore have cost a trifle under 4 per cent. to carry out, including 5,387 separate day-labour works, averaging in cost only £10 13s. 4d. each, and upwards of 1,000 contracts for works costing under £200, and scattered throughout both the near and the remote localities of the State.

But besides these the salary list covers the large amount of drafting, &c., on works projected, but abandoned, and also all the services of officers on professional works not represented by any actual expenditure passing through the hands of the accountant.

The

The only complete return and analysis upon which any deductions can possibly be made is that now before me for the purpose of preparing this report, and not hitherto available. Any calculations based on merely the relation of a salary list to actual expenditure on works, and without taking into account the general work in all its stages of a State architect's office, is altogether unreliable.

The following comparative statement has been compiled from the official returns of the Branch, covering operations from 1st July, 1906, to 30th June, 1908, showing the actual professional cost distributed over the several classes of service rendered, and what such cost would have been if based on the charges established by the Institute of Architects of New South Wales.

Professional Services Rendered.		Departmental Costs based on total Salaries paid.		Institute Rate of Charges.		
		Rate.	£	Clause.	Rate.	£
Preliminary Sketches and Designs—	£					
Head Office	376,411					
Country	88,360					
	£464,771					
Charge on 50% only as abortive and not subsequently of use	232,385	No charge.		XI.	1¼ per cent.	2,903
Alterations and Repairs under £200—						
Working Plans and Specifications—						
Head Office	2,291					
Country	45,491					
	£47,782	1½ per cent.	716	XIII.	3½ per cent.	1,672
Supervision—						
Head Office	11,014					
Country	45,491					
	£56,505	2 per cent.	1,130	XIII.	3½ per cent.	1,977
New Buildings over £200—						
Working Drawings and Specifications—						
Head Office	654,167					
Country	97,977					
	£752,144	1¼ per cent.	9,401	III.	2½ per cent.	18,802
Supervision and Details—						
Head Office	344,827					
Country	97,977					
	£442,804	1¼ per cent.	5,535	III.	2½ per cent.	11,070
Day Labour—						
5,387 Works	57,456	5 per cent.	2,872	VI.	7 per cent. or higher rate as per special agreement.	4,021
Measuring and Valuing—						
Buildings for Rail and Tram Resumptions—58 Valuations	21,473	No charge.		None specified.	2 per cent.	429
Inspections Public Buildings for Theatrical Licenses—						
92 Buildings		No charge.		None specified.	£2 2s.	193
Professional Services, Government Architect—Transferred Properties—Valuations (£4,000,000)		No charge.		By fee.	...	1,050
Attendance on Reference Board		No charge.		Paid Member.	...	200
Professional Services : Arbitrations, Hospital Plans, Capital City Sites, &c., &c., by Government Architect and the Assistant Architects		No charge.		None specified.		
			£19,654			£42,317

The estimated departmental cost of £19,654 practically assimilates with the actual amount of salaries paid, viz., £19,597. The deduction to be drawn is that the Department effected a saving of no less than £22,663 as against placing the work in the hands of a number of private architects and paying for their services at the rates insisted upon by the Institute.

The foregoing comparative statement does not include the salaries of clerks on works over £3,000, which would be the same under either arrangement.

Travelling expenses are also not dealt with. In this case the advantage would be with the Department as against the Institute, which requires payment for time during professional country visits in addition to bare expenses.

The comparatively small item of stationery is not dealt with; this should be debited against the Department.

In computing the country work no distinction has been made regarding works partly carried out during the financial year and those wholly so, as this in a series of years rectifies itself.

W. L. VERNON,
Government Architect.

6th November, 1908.

Local Government.

Third Report of Officer-in-charge, Local Government, period ended 30th June, 1908.

In the year just closed the formative work of the two preceding periods has been continued. The Shire Councils ended their first year of the full operation of the Local Government Act on the 31st December, 1907; while the Municipal Councils opened their first year, with the whole of the provisions of the new law in operation, on 1st January, 1908, the date on which the valuation and rating sections came into operation.

Compilation of Lists and Rolls of Electors.

In the latter half of the year 1907 the lists and rolls of electors and ratepayers in Shires were re-compiled by the Shire Councils' own staffs, the previous lists and rolls having been collected by the police.

At the same time, the lists and rolls of electors and ratepayers for Municipalities under the extended franchise of the new law were compiled for the first time.

In this work no serious difficulty was experienced, except in one respect, viz., what are known under the Act as "oral tenancies." Those "occupiers" in Municipalities who possessed the necessary qualifications under the Act for enrolment, but did not hold written leases, were required by the Act to make statutory declarations as to the terms of their tenancies as a condition precedent to enrolment. Large numbers of persons neglected to do this, and consequently were not enrolled.

The rolls thus compiled are the first under the new system, which provides for collection of general rolls once in three years instead of annually. In the two years following the year of preparation of the general rolls, supplementary rolls will be prepared. These will not be compiled, as were the general rolls, by collectors making a house-to-house visitation. Persons desiring enrolment on the Supplementary Rolls must make application. The next general collection of names will be due in the latter half of 1910, and will be available for the General Election to be held early in 1911.

Fixing of Number of Aldermen for Each Municipality.

Before the General Election of 1908 could be held, it was necessary for the Governor to fix the number of Aldermen to constitute the Council of each Municipality in the State under the new law. The opinions of each of the Councils were sought and considered, and the numbers were fixed by Proclamations, which were gazetted on 20th November, 1907, and 18th December, 1907, and 8th January, 1908.

In practically every case the number of aldermen fixed was the same as the number of which the Council was, at the repeal of the Municipalities Act, composed.

In one Council the number was fixed at 15 aldermen; in 44 Councils the number was fixed at 12 aldermen; in 113 Councils the number was fixed at 9 aldermen; in two Councils the number was fixed at 7 aldermen; in 31 Councils the number was fixed at 6 aldermen.

In each case where a Municipality was divided into wards, the number for each ward was fixed at three, as before.

General Election.

The whole of the aldermen who were in office when the Local Government Act came into force on 1st January, 1907, were continued in office by the operation of the Act until the last Friday in January this year (31st January). On the following day a general election of aldermen for all the Municipalities in the State took place.

At the same time, the Shire Councillors who were elected on 24th November, 1906, retired from office, and a general election of Councillors for all the Shires in the State was held on 1st February.

The elections were conducted without difficulty occurring, from an administrative point of view; but a number of valuable lessons were learned, as the result of which the ordinances providing the machinery for elections, which were at that time undergoing revision, with a view to consolidation, were perfected.

The aldermen and Councillors elected on 1st February, 1908, will hold office until the last Friday in January, 1911, and their successors will be elected the next day.

In the past the Municipal elections fell on a Tuesday. As will be seen, the general elections under the Local Government Act will always fall on a Saturday.

Shire Rating and Suspension of Land Tax.

At the date of the last report of this office (30-6-1907) the Land Tax had not been suspended in all the Shires. Before the close of the Shire year (31-12-1907), however, the remainder of the Councils levied their general rates, and, thereupon, proclamations were issued suspending the operation of the Land Tax Acts.

Urban Areas in Shires.

During the year proposals were received from 9 Shire Councils for the establishment of 16 Urban Areas. Of these, 13 were approved and Gazetted, and one was not granted. The remaining two are still under consideration.

Endowment of Shires.

Under the "Classification" of Shires made on 31st December, 1906, some 87 Shires were entitled to receive endowment at varying rates in the £ upon their general rate collections of the "preceding year"—*vide* Section 161 of the Local Government Act.

In the preceding year (1906), however, no shire rates were collected—that being merely a year of preparation; so there were no sums of rates received on which to calculate the endowments.

Under these circumstances it was decided to pay the endowments for the Shire year 1907 on the estimated proceeds of a 1d. rate; £180,000 was voted by Parliament for the purpose, and of this £179,135 was paid to the 87 Shires entitled to endowment. The amount paid to each Shire is shown in *Appendix* I. hereto.

Temporary

Temporary Loans—Shires.

During the year ending 30th June, 1907 (as shown in Appendix II to last annual report), "consent" was given by the Minister under Section 176 to 85 Shire Councils obtaining Temporary Loans amounting to £69,827. In addition to this, arrangements were made whereby 6 of these Councils obtained loans in excess of the limit provided in the Act totalling £2,525, so that the aggregate amount of the Shire temporary loans authorised up to 30th June, 1907, was £72,352.

During the year ended 30th June, 1908 (as shown in *Appendix* II, Part A, to this report), "consent" was given to 79 Shire Councils to borrow £50,338 16s. 10d. within the limit allowed by law, and for 34 Councils arrangements were made whereby they could borrow further sums totalling £27,415 13s. 4d. The aggregate of temporary loans authorised in the twelve months ended 30th June, 1908, was, therefore, £77,754 10s. 2d.

By far the greater portion of the loans above mentioned, authorised during the eighteen months ended 30th June, 1908, were obtained before 31st December, 1907, and the statements of accounts for period ended 31st December, 1907, show that in the great majority of cases the sums borrowed were repaid by that date.

Temporary Loans—Shires—in Excess of Limit..

In last year's report mention was made of the circumstances under which arrangements were made whereby certain Shires could borrow in excess of the limit provided in this Act. The amount of these excess borrowings is included in the figures given in the preceding paragraph of this report; but in view of the exceptional nature of the transaction, information is here given with regard to these excess borrowings separately.

In part B of *Appendix* II is a statement of a whole of these excess borrowings for both 1907 and 1908, together with information as to repayments.

From this it will be seen that the total amount of the excess borrowings of Shires was £31,940, of which £27,361 has been repaid, while there are only two Shires out of 38 which still owe more than the limit allowed by the Act, the total amount involved in the two cases being £4,579.

Temporary Loans—Municipalities.

Up to 30th June, 1907, "consent" had been given to 24 Councils of municipalities to temporarily borrow £28,828 19s. 11d. No arrangements were made for borrowing in excess of the limit fixed in the Act.

During the twelve months ended 30th June, 1908, similar "consent" was given to 95 Municipalities to borrow £116,622 13s. 4d. (See *Appendix* III.)

Information is not yet available as to the extent of the repayments.

Temporary Loans—Purposes of.

In almost all cases these Temporary Loans were obtained by Councils for the purpose of meeting their current expenses in carrying on ordinary road and bridge and local Government administrative work during the period which occurs every year between the spending of the previous year's revenue and the collection of that for the current period.

Municipalities—Renewals of Fixed Loans.

Nineteen Municipalities have obtained the Governor's approval during the past twelve months to borrow various sums totalling £110,282 13s. 10d. for the purpose of repaying loans falling due, which originally amounted to £114,882 13s. 10d. The difference between these two amounts (£4,600) represents the amounts which the Councils had already paid off the loans out of revenue, or had set by in cash for purposes of repayment.

In 8 out of these 19 cases the Councils do not propose to make any annual appropriation for purposes of repayment, while in the remaining cases the Councils express their intention to set aside varying sums each year for this purpose. The provisions of the Local Government Act respecting compulsory loan rates and provision for sinking funds do not apply to these loans, as they are for the repayment of loans obtained before the passing of the existing law. (See *Appendix* IV.)

New Fixed Loans—Municipalities.

In two cases authority has been given for new loans by Councils of Municipalities, the total amount authorised being £9,000.

These are cases of special character. Casino had obtained authority to borrow under the late Municipalities Act, but had not completed its arrangements when that Act was repealed, so that fresh authority had to be given under the Local Government (Amending) Act, 1907. The Council propose to provide a Sinking Fund of 1 per cent. per annum from rates in addition to interest.

Albury, in somewhat similar circumstances, was authorised under the Municipal Loans Authorisation and Validation Act, 1906, to borrow £4,000 for Town Hall, no special provision being made for sinking fund. (See *Appendix* No. V.)

Proposed New Loan under Local Government Act.

During the period under review there was only one proposal brought forward for a new loan to which the new procedure of the Local Government Act fully applied. This was in the case of Gilgandra Shire Council, which proposed to borrow £200 in order to instal a sanitary service for the Gilgandra Urban Area. The necessary preliminaries having been complied with, an inquiry was held locally by an officer appointed by the Governor, and his report was favourable to the proposal. The loan rate which would have been necessary under the Act in connection with the loan would have been about £50 per annum, £10 for interest and £40 for sinking fund, and this the Council proposed to raise by a Local Loan Rate of 1d. in the £ on the unimproved capital value of the land in Gilgandra Urban Area (unimproved capital value, £12,000).

In accordance with the Act a poll of Ratepayers of Gilgandra Urban Area was taken. On the question whether the Council be authorised to borrow, the voting was 7 for and 13 against. On the question of what rate the loan should be levied on, in case the poll approved of the loan, the voting was for Unimproved Capital Value 11 votes, for Improved Capital Value, 4 votes. The decision of the poll being against the loan, the proposal was abandoned.

Loan

Loan Guaranteed by the Government.

By the Local Government Act, 1906, the Government is authorised to guarantee the loans of Councils, where after investigation by the Treasury, such guarantee is recommended. Up to the present such guarantee has been given in one case only—a loan of £6,000 obtained by the Municipality of Lithgow—on condition that the Council levy the loan rate provided by the Local Government Act, and that the Sinking Fund Allotments be invested by the Council in Government Securities of New South Wales.

Alterations of Ward Boundaries.

During the year the Ward Boundaries of the following Municipalities were altered by way of a fresh division into Wards under the Local Government Act:—Granville, St. Mary's, Smithfield and Fairfield, Berry, Balmain, Grafton, Ashfield, Willoughby, and Petersham.

The Councils of the Municipalities of Alexandria, Erskineville, Hurstville, Wickham, Rockdale, and Leichhardt, also petitioned for alteration of the Ward boundaries of their respective Municipalities, but action with respect thereto had not been completed at 30th June, 1908.

Abolition of Wards in Municipalities.

Since last report the Wards in eight Municipalities have been abolished, viz.:—Lithgow, Bowral, Cudgegong, Hay, Gundagai, Nowra, Armidale, and Liverpool. These municipalities are now single electorates, the aldermen being elected by the electors of the whole municipality. They therefore represent the whole municipality, not particular sections, and will probably feel a little more freedom to conduct their municipal administration with an eye to the good of the whole area.

Abolition of Tolls on Ferries.

While the public ferries were under the control of the State Government, it was the practice to charge a small fee for ferry transit. On the transfer of ferries to the control of the various Shires and Municipal Councils, those Councils continued the system of making a charge for the service.

The question of abolishing the charge on ferries was considered by the Government during the past year, and it was decided to make arrangements whereby this should be done. Accordingly, all ferries which had been transferred from the Government to the local bodies were freed from tolls on 1st December, 1907, and arrangements have been made whereby the Government compensates the Councils for the net loss occasioned by the change.

Municipal Rating and Suspension of Land Tax.

By a proclamation dated 3rd December, 1907, the provisions of the valuation and rating sections of the Act were brought into operation in municipalities, as from 1st January, 1908. Up to the 30th June, 1908, 124 Councils of Municipalities had made their General Rates for 1908 on the Unimproved Capital Value of rateable land, and, on the necessary certificates being furnished to this office, the operation of the Land Tax Acts was suspended in those Municipalities.

Land Tax Lists—Municipalities.

With the object of assisting the Municipal Councils as much as possible in the work of re-compiling their valuation books and making the valuations of Unimproved Capital Value under the new Act, the Government directed the preparation from the records of the Land Tax Department of Lists of Lands, Owners, and Values, for each Municipality. These were completed and supplied to all Municipal Councils before the end of the year 1907, in readiness for the valuations of 1908.

Municipal Rates.

The Local Government Act requires the Councils of Municipalities to make and levy a general rate (not less than 1d.) on the unimproved capital value of rateable land, and empowers the Councils to raise any additional amount which they need for general purposes either (a) by making the general rate itself more than 1d. in £ on unimproved capital value, or (b) by making an additional general rate on unimproved capital value, or (c) by making an additional general rate on improved capital value.

The question of what basis of rating should be adopted was the principal one on which candidates at the municipal general election on 1st February, 1908, addressed the electors. In by far the greater number of councils a majority of the aldermen elected were in favour of rating only on the unimproved capital value, as distinguished from rating partly on unimproved capital value and partly on improved capital value.

Where a Council proposed to make the general rate higher than 1d. on unimproved capital value, the Act did not authorise ratepayers to demand a poll on the question of the basis of the excess over 1d. Most of the Councils therefore decided to levy simply a general rate—not a general and an additional general rate. In a few cases the Councils, while in favour of rating only on the unimproved capital value, decided to give the ratepayers an opportunity of demanding a poll as to the basis of rating, and therefore notified the proposed rates as a general rate of 1d., and an additional general rate (of varying amounts in different cases), both on unimproved capital value. A few other Councils proposed a general rate of 1d. on unimproved capital value and an additional general rate on improved value. In most of the cases where an additional general rate on improved capital value was proposed the ratepayers demanded a poll. The results of these polls in, I believe, every case, were in favour of the basis of rating being the unimproved capital value. The Councils are not required to furnish the Department with information as to proposed rates and polls demanded, so that definite information, and figures showing the rates and the votes cast, cannot be furnished. Out of a total of 124 municipalities with respect to which information was available on 30th June, 1908, 122 had rated for general purposes on unimproved capital value alone, and 2 partly on unimproved capital value and partly on improved capital value.

In addition to this, information has been received which shows that in 13 municipalities the special water rates are on unimproved capital values, while in 8 these rates are on improved capital value; and in 11 municipalities the special lighting rates are on unimproved capital value, while in 4 the lighting rates are on improved capital value.

Though the information is not complete, it shows very clearly the trend of public thought as to the basis of municipal taxation. It is yet too early to say what the effect of the change has been upon the value of land.

Creation of New Municipalities.

Applications were received for the incorporation of new municipalities at Mullimbimby, West Wallsend, West Wyalong, and Blackheath. After full consideration and inquiry Mullumbimby was proclaimed a municipality, with a council to be composed of six aldermen, in *Gazette* dated 24th June, 1908. The council were elected on 12th September, 1908, and are now entering upon their duties.

In the other cases the applications have not been granted.

Dissolution of Municipalities and their addition to Shires.

The Municipality of Silverton having been for some years without a Council, and the town itself having almost ceased to exist as such, a proclamation was gazetted on 25th September, 1907, whereby the Municipality was dissolved.

During the twelve months ended 30th June, applications were received from the Councils of Gosford, Hill End, Gundagai, and Uralla, praying that the Municipalities be dissolved and incorporated with the surrounding Shires, viz, Erina, Turon, Adjungbilly and Gostwyck respectively. The necessary inquiries were made, and the Councils of the Municipalities and Shires concerned brought into consultation, with the result that Gosford Municipality was added to Erina Shire by *Gazette* dated 22nd January, 1908; and Hill End was added to Turon Shire by *Gazette* dated 17th June, 1908. In the case of Gundagai, the request was not granted in view of the reluctance of the Adjungbilly Council to assume further responsibilities until they have had more experience of Local Government work; and in the case of Uralla, the Municipal Council who petitioned for the Municipality to become an additional, or fourth, riding, to the Gostwyck Shire, on being informed that the Act only provided for a Shire to be divided into three, six or nine ridings, decided to allow the question of amalgamation to remain in abeyance.

Accounts System—Municipalities.

The draft of the new system of account-keeping for Municipalities was completed by the Committee appointed for the purpose (*vide* last report), and was issued on 25th November, 1907, to all Municipal Councils, in order that the officers might have an opportunity to study it before it came into operation, and might have opportunities to criticise it. A number of objections were made on the ground that it would largely increase the office work, while, on the other hand, a number of communications were received from Council Clerks of experience supporting the proposed change. Regulation No. 305, embodying the new system, was gazetted on 5th February, 1908, and came into operation at the close of the Municipal year 5/2/08.

So far as can be judged at present, the Regulation is working well, but experience may show that minor amendments may be necessary, not in the system of book-keeping, which is in conformity with commercial practice, but in the form of some of the annual statements of accounts, one or two of which may, in a sense, be considered experimental.

Audit—Defalcations.

The work of the new Auditors has been, on the whole, satisfactorily performed, though there re indications of unsatisfactory work in one or two cases, which are receiving attention. The Auditors' duties have, however, been unusually difficult, involving the performance by them of much work in the way of instruction, which can hardly be considered to be really part of an audit. In view of this, the Department has exercised some discretion in dealing with cases of delay in audit. Some of the Auditors appear, however, to be undertaking the work of more Councils than they can reasonably hope to be able to complete in the period available for audit, and this phase of the situation may need further consideration during the coming year.

During the year under review the Local Government Examiners (Inspectors of the Audit Department) have done good work. Their other duties do not leave them sufficient time to make complete audits of the Councils' accounts, nor is that necessary in view of the fact that the Councils have their own Auditors for that work. The Examiners therefore confine themselves to applying tests and checks to the accounts at unexpected times, and ascertaining whether the Auditors have done their work efficiently. The attention of many of the Auditors has, consequently, been drawn to deficiencies in their work, and the result of this will, it is hoped, be a greater degree of efficiency in the future.

The principal cases of default brought under notice from 1/7/07 to 30/6/08 were as follow:—

1. Town Clerk—Municipality of.....—Deficiency, £92 4s.—Amount made good—Resigned.
2. Town Clerk—Municipality of.....—Defalcation, £43 8s. 1d.—Twelve months' imprisonment.
3. Shire Clerk—Shire of.....—Defalcations, £181 9s. 5d.—Warrant issued—Absconded—£100 recovered from guarantee society.
4. Town Clerk—Municipality of.....—Deficiency, £66 4s. 7d.—Sentenced to imprisonment.

Examinations for Council Clerks, Engineers and Auditors.

During the twelve months ended 30th June, 1908, examinations for certificates of qualification were held as follows:—For Clerks and Auditors, three examinations—on 21st November, 1907; 14th January, 1908, and 1st and 2nd May, 1908; for Engineers, one examination, on 23rd March, 1908. The results of these examinations were as follows:—Clerks' examination, 137 candidates, 40 passes; Auditors' examination, 72 candidates, 26 passes; Engineers' examination, 3 candidates, 1 pass.

Revision and Consolidation of Ordinances.

At the request of the Councils of Shires and of Municipalities, the Department undertook to separate the Ordinances which apply to Shires, and those which apply to Municipalities, into two quite distinct codes, in order to facilitate reference, and to remove doubts. This promise has been redeemed by the publication of the two codes in the *Gazette* of 14th May, 1908.

In

In the revision of the Ordinances the Department has had the assistance of two experienced Council Clerks, Messrs. A. Vialoux (Paddington), and P. Somerville (Rockdale), and of Messrs. R. J. Browning, M.A., and Jas. Young, B.A., LL.B., Barristers at Law, gentlemen who have made a special study of Local Government Law, and offered their services gratuitously in this connection.

The elimination of unnecessary matter, and the condensation of that retained, has resulted in such a reduction that, notwithstanding the addition of the new provisions referred to above, and the addition of synopsis and index, the new code is not appreciably larger than the previously existing volume.

Local Government Engineer's Report.

I submit herewith a separate report by the Local Governmant Engineer on that part of the work of the Branch with which he is immediately concerned.

Conclusion.

In accordance with instructions this report is condensed to a short categorical statement of the principal work of the year.

I have again to acknowledge the exceptionally good work of the officers on the staff, practically all of whom have shown an increase of efficiency during the year, and, as will be seen by reference to my last report, this is high praise, but it is well-earned.

I have, &c.,
J. GARLICK,
Officer-in-Charge, Local Government.

The Under Secretary, Public Works Department.

Appendix I.

Endowments to Shires, 1907.

Name.	Amount.	Name.	Amount.	Name.	Amount.
	£		£		£
Abercrombie	3,234	Gadara	3,396	Narraburra	1,015
Amaroo	889	Germanton	591	Nattai	1,716
Apsley	344	Gilgandra	201	Nepean	845
Ashford	1,105	Gloucester	899	Oberon	2,184
Bannockburn	945	Goodradigbee	1,187	Orara	2,303
Barraba	523	Gostwyck	803	Patrick Plains	675
Baulkham Hills	1,467	Gundurimba	2,666	Port Stephens	2,560
Bellingen	5,992	Gunning	1,118	Rylstone	982
Bibbenluke	931	Guyra	2,260	Severn	3,181
Blacktown	1,370	Gwydir	1,151	Stroud	3,830
Blaxland	2,992	Harwood	2,582	Sutherland	672
Blue Mountains	893	Hastings	5,684	Tallaganda	3,602
Boree	1,527	Hornsby	793	Tenterfield	4,563
Byron	2,684	Hume	291	Terania	1,662
Cambewarra	1,352	Imlay	3,581	Tintenbar	3,400
Canobolas	2,018	Kyogle	2,333	Tomki	2,210
Cessnock	2,706	Lake Macquarie	820	Tumbarumba	1,271
Clyde	3,524	Lyndhurst	1,554	Turon	2,406
Cobbora	330	Macintyre	1,265	Tweed	4,014
Cockburn	638	Macleay	4,610	Wallarobba	3,244
Colo	3,163	Macquarie	261	Warringah	1,127
Coonabarabran	1,232	Mandowa	658	Waugoola	536
Copmanhurst	2,864	Manning	5,855	Weddin	434
Crookwell	1,477	Meroo	1,542	Wingecarribee	2,449
Dalgety	2,789	Monaro	1,632	Wollondilly	3,074
Dorrigo	7,145	Mulwaree	2,673	Woodburn	2,870
Dumaresq	3,223	Mumbulla	1,204	Wyaldra	1,568
Erina	4,246	Murrungal	1,231	Yallaroi	331
Eurobodalla	4,526	Muswellbrook	219	Yarrowlumla	1,219
					£179,135

Appendix II.

Appendix II—Part A.

TEMPORARY Loans.

Shires.

Shire.	Under Section 176 within limit.	In excess of limit.	Total.	
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Abercrombie	500 0 0	.....	500 0 0	
Adjungbilly	.....	* 1,000 0 0	1,000 0 0	
Apsley	.....	* 500 0 0	500 0 0	
Bellingen	500 0 0	.....	500 0 0	
Berrigan	1,625 0 0	.....	1,625 0 0	* 225 0 0
Bland	500 0 0	.....	500 0 0	
Blaxland	500 0 0	.....	500 0 0	
Blue Mountains	600 0 0	.....	600 0 0	
Bogan	.....	* † 500 0 0	500 0 0	
Bolwarra	.....	* † 350 0 0	350 0 0	
Bulli	1,000 0 0	* 500 0 0	1,500 0 0	
Byron	1,200 0 0	.....	1,200 0 0	
Cambewarra	350 0 0	.....	350 0 0	
Carrathool	500 0 0	.....	500 0 0	
Cessnock	995 0 0	.....	995 0 0	
Cobbora	650 0 0	* 400 0 0	1,050 0 0	
Cockburn	850 0 0	* 1,150 0 0	2,000 0 0	
Coolah	500 0 0	.....	500 0 0	
Coolamon	730 0 0	* 730 0 0	1,460 0 0	
Coonamble	300 0 0	.....	300 0 0	
Coreen	1,000 0 0	* 1,000 0 0	2,000 0 0	
Crookwell	1,000 0 0	.....	1,000 0 0	
Culcairn	170 0 0	* 200 0 0	370 0 0	
Demondrille	.....	* 600 0 0	600 0 0	
Deniliquin	500 0 0	.....	500 0 0	
Dorrigo	779 0 0	.....	779 0 0	
Gadara	* 600 0 0	.....	600 0 0	
Germanton	288 0 0	.....	288 0 0	
Gloucester	500 0 0	.....	500 0 0	
Goobang	.....	* 600 0 0	600 0 0	
Gundurimba	1,000 0 0	.....	1,000 0 0	
Gwydir	450 0 0	.....	450 0 0	
Harwood	687 13 4	.....	687 13 4	
Hornsby	.....	600 0 0	600 0 0	
Hume	1,000 0 0	* † 1,250 0 0	2,250 0 0	
Illabo	951 0 0	* 771 13 4	1,722 13 4	
Jindalee	700 0 0	* † 777 0 0	.....	
,,	.....	* † 350 0 0	1,827 0 0	
Kyeamba	.....	* † 995 0 0	995 0 0	
Ku-ring-gai	2,828 0 0	* 2,000 0 0	4,828 0 0	
Lake Macquarie	1,000 0 0	.....	1,000 0 0	
Lockhart	* 650 0 0	.....	650 0 0	
Lyndhurst	* 763 0 0	* 865 0 0	1,628 0 0	
Macleay	1,600 0 0	.....	1,600 0 0	* 800 0 0
Manning	1,000 0 0	3,027 0 0	4,027 0 0	
Marthaguy	700 0 0	.....	700 0 0	
Mitchell	391 0 0	.....	391 0 0	
Monaro	700 0 0	.....	700 0 0	
Mulwaree	539 0 0	.....	539 0 0	
Mumbulla	800 0 0	.....	800 0 0	
Murray	.....	* 800 0 0	800 0 0	
Murrungal	.....	* 150 0 0	150 0 0	
Muswellbrook	.....	* 500 0 0	500 0 0	
Namoi	1,500 0 0	.....	1,500 0 0	
Narraburra	794 0 0	.....	794 0 0	
Nattai	300 0 0	.....	300 0 0	
Nundle	.....	* 500 0 0	500 0 0	
Orara	312 0 0	.....	312 0 0	
Peel	.....	* 1,000 0 0	1,000 0 0	
Severn	1,200 0 0	.....	1,200 0 0	
Talbragar	643 3 6	* 500 0 0	1,143 3 6	
Tallaganda	690 0 0	.....	690 0 0	
Tamarang	1,500 0 0	.....	1,500 0 0	
Tarro	1,098 0 0	* 1,000 0 0	2,098 0 0	
Tenterfield	1,000 0 0	.....	1,000 0 0	
Terania	1,260 0 0	.....	1,260 0 0	
Timbrebongie	400 0 0	* 500 0 0	900 0 0	
Tumbarumba	924 0 0	.....	924 0 0	* 462 0 0
Turon	500 0 0	.....	500 0 0	
Tweed	1,000 0 0	.....	1,000 0 0	
Urana	981 0 0	* 769 0 0	1,750 0 0	* 500 0 0
Wakool	.....	* 650 0 0	650 0 0	
Walgett	319 0 0	* 281 0 0	600 0 0	
Weddin	500 0 0	.....	500 0 0	
Windouran	330 0 0	* 500 0 0	.....	
,,	.....	* 700 0 0	1,530 0 0	
Wallarobba	* 500 0 0	.....	500 0 0	
Wollondilly	* 1,000 0 0	.....	1,000 0 0	
Woolooma	.....	* 500 0 0	500 0 0	
Yanko	1,000 0 0	.....	1,000 0 0	
Yarrowlumla	691 0 0	* 900 0 0	1,591 0 0	
	£50,338 16 10	£27,415 13 4	£77,754 10 2	

* Repaid or cancelled. † Consent dated June, 1907, issued in July, 1907.

Appendix II—Part B.

TEMPORARY Loans approved by Minister in excess of Legal Limit.

Shires.

Shire.	Amount.	Date of consent.	Remarks as to payment as shown by Financial Statement
	£		
Adjungbilly	1,000	29 July, 1907	Repaid, 31 Dec., 1907.
Apsley	500	19 Sept. ,,	,, 30 June, 1908.
Bogan	500	28 June ,,	,, 31 Dec., 1907.
Bolwarra	350	25 ,, ,,	,, ,, ,,
Bulli	500	3 Sept. ,,	,, 121/55/103.
Canobolas	*600	29 April ,,	,,
Cobbora	400	25 Sept. ,,	,, 31 Dec., 1907.
Cockburn	*1,150	24 July ,,	,,
Coolamon	730	13 Aug. ,,	,, 08/78/109-82.
Coreen	1,000	29 June ,,	,, 70/54/169.
Culcairn	245	1 ,, ,,	,, 31 Dec., 1907.
,,	200	17 Sept. ,,	,, ,, ,,
Demondrille	*600	6 Oct. ,,	,, ,, ,,
Goobang	600	22 Aug. ,,	,, ,, ,,
Hornsby	300	29 May ,,	Outstanding, 31 Dec., 1907.
,,	600	29 Oct. ,,	,, ,, ,,
Hume	1,250	28 June ,,	Repaid, 08/71/46-314.
Illabo	771	15 July ,,	,, 31 Dec., 1907.
Jindalee	*777	26 June ,,	,, ,, ,,
,,	*350	26 Oct. ,,	,, ,, ,,
Ku-ring-gai	2,000	13 Sept. ,,	,, ,, ,,
Kyeamba	*995	28 June ,,	,, ,, ,,
Lyndhurst	*865	9 July ,,	,, ,, ,,
Manning	*1,827	23 Nov. ,,	,,
,,	1,200	29 April, 1908	£1,348 repaid; £3,679 outstanding.
,,	2,000	22 Aug. ,,	
Macquarie	*600	29 April, 1907	Repaid, 31 Dec., 1907.
Murray	800	18 Nov. ,,	,, ,, ,,
Murrungal	*150	19 Oct. ,,	,, ,, ,,
Muswellbrook	*500	1 July ,,	,, ,, ,,
Nundle	500	25 ,, ,,	,, ,, ,,
Peel	1,000	20 Sept. ,,	,, ,, ,,
Tamarang	*500	16 May ,,	,, ,, ,,
Talbragar	500	8 July ,,	,, 84/46-709.
Tarro	1,000	13 Sept. ,,	,, 31 Dec., 1907.
Terania	280	18 June ,,	,, 380-718.
Timbrebongie	500	22 Oct. ,,	,, 31 Dec., 1907.
Urana	269	10 July ,,	,, ,, ,,
,,	500	26 Oct. ,,	,, ,, ,,
Wakool	650	13 Aug. ,,	,, ,, ,,
Walgett	*281	12 Sept. ,,	,, ,, ,,
Windouran	*500	19 Aug. ,,	,, ,, ,,
,,	*700	18 Oct. ,,	,, ,, ,,
Woolooma	500	2 July ,,	,, ,, ,,
Yarrowlumla	900	12 Aug. ,,	,, ,, ,,
	£31,940		

* Nothing to show how repaid, but balance-sheet shows no liability.

Appendix III.

TEMPORARY LOANS.

Municipalities.

Municipality.	Date.—1907-1908.	Amount.
		£ s. d.
Adamstown	14 March	100 0 0
Aberdeen	23 June	125 0 0
Albury	23 April	1,200 0 0
Alexandria	29 November	1,200 0 0
Annandale	23 March	1,500 0 0
Ashfield	21 January	*3,000 0 0
,,	27 February	3,000 0 0
,,	28 April	3,000 0 0
Auburn	14 March	500 0 0
Ballina	23 April	300 0 0
Balmain	4 March	2,000 0 0
Bankstown	27 November	*187 0 0
,,	29 April	400 0 0
Bathurst	6 April	1,237 0 0
Berry	26 March	100 0 0
Bexley	17 March	850 0 0
Botany	14 April	600 0 0
Botany North	15 November	450 0 0
Bowral	5 April	250 0 0
Broken Hill	2 June	7,000 0 0
Burwood	31 January	1,000 0 0
Cabramatta and Canley Vale	30 March	100 0 0
Camden	20 March	226 0 0
Carrington	31 March	200 0 0
Casino	17 February	1,000 0 0
Concord	22 January	500 0 0
Condoublin	24 March	150 0 0
Corowa	23 April	300 0 0

* Repaid or cancelled.

TEMPORARY LOANS—*continued.*

Municipality.	Date.—1907-1908.	Amount.		
		£	s.	d.
Dundas	23 March	125	0	0
Eastwood	5 May	100	0	0
Enfield	4 March	500	0	0
Gerringong	23 April	200	0	0
Glebe	17 March	4,000	0	0
Grenfell	30 March	75	0	0
Goulburn	30 July	*1,000	0	0
,,	27 April	1,000	0	0
Gundagai	2 March	200	0	0
Hillgrove	23 March	100	0	0
Homebush	23 March	100	0	0
Hunter's Hill	28 March	600	0	0
Hurstville	25 February	380	0	0
Illawarra Central	23 April	500	0	0
Illawarra North	4 April	450	0	0
Inverell	21 April	500	0	0
Jerilderie	7 April	163	0	0
Junee	27 May	500	0	0
Kempsey	16 March	323	0	0
Kiama	11 May	219	0	0
Leichhardt	19 March	2,000	0	0
Lithgow	7 March	1,100	0	0
,,	16 May	1,500	0	0
Liverpool	10 June	1,000	0	0
Manly	23 August	1,000	0	0
,,	4 March	1,000	0	0
Marrickville	10 January	2,000	0	0
,,	15 April	*2,000	0	0
Merewether	27 March	200	0	0
Mosman	12 March	1,196	0	0
Moss Vale	10 March	300	0	0
Murrurundi	1 February	*100	0	0
,,	12 February	100	0	0
Mudgee	10 April	250	0	0
Murwillumbah	7 January	209	0	0
Musclebrook	15 April	412	0	0
Narrandera	15 April	500	0	0
Newcastle	30 March	6,798	13	4
Newtown	25 February	4,000	0	0
Nyngan	5 April	250	0	0
North Sydney	9 December	6,000	0	0
,,	1 April	3,000	0	0
Nowra	13 April	300	0	0
Orange East	30 March	23	0	0
Paddington	31 January	3,500	0	0
Petersham	13 March	*2,000	0	0
Quirindi	26 March	300	0	0
Randwick	15 January	2,500	0	0
,,	19 May	2,000	0	0
Redfern	12 February	4,000	0	0
,,	6 June	1,000	0	0
Richmond	26 June	100	0	0
Rockdale	22 October	*600	0	0
,,	31 January	1,000	0	0
Rookwood	23 March	400	0	0
Singleton	29 April	800	0	0
Strathfield	7 January	1,000	0	0
Stockton	10 March	300	0	0
Tamworth	23 March	250	0	0
,,	21 April	297	0	0
Temora	15 May	529	0	0
Tenterfield	16 June	400	0	0
Tumut	20 March	300	0	0
Ulladulla	25 May	200	0	0
Ulmarra	22 April	50	0	0
Vaucluse	12 February	500	0	0
Wagga Wagga	25 April	800	0	0
Walcha	20 March	50	0	0
,,	3 April	150	0	0
Waratah	14 February	500	0	0
Waterloo	31 March	300	0	0
,,	13 May	500	0	0
Waverley	3 February	2,000	0	0
,,	23 March	2,000	0	0
West Maitland	24 March	639	0	0
Wellington	10 March	500	0	0
,,	16 June	430	0	0
Wickham	31 March	500	0	0
Willoughby	3 March	2,000	0	0
Windsor	4 May	100	0	0
Woollahra	21 January	3,900	0	0
,,	15 May	2,000	0	0
Wollongong	30 November	*622	0	0
,,	28 February	622	0	0
Wrightville	3 April	100	0	0
Wyalong	11 March	135	0	0
	£	116,622	13	4

*Repaid or cancelled.

Appendix IV.

Fixed Loans—Renewals.

Municipality.	Purpose of original Loan.	Loan first authorised.	Original Amount.	Amount paid off since first borrowed.	Present amount for which approval has been given to borrow.	Remarks.
			£	£	£	
Adamstown ...	Permanent improvements.	20 Sept., 1887	1,000	.....	1,000	No Sinking Fund.
Burwood.....	do.	15 Nov., 1881	7,500	.....	14,950	No Sinking Fund.
,,	....	27 Sept., 1887	6,500	.....		
,,	....	27 July, 1900	1,500	550		
Botany	Town Hall.	23 Sept., 1887	2,000	900	1,000	Sinking Fund—£100 per annum.
Carrington.....	Permanent improvements.	18 Jan., 1893	3,000	1,000	2,000	Sinking Fund—10% from rates
Casino.....	do	19 Nov., 1887	2,000	.....	2,500	No Sinking Fund.
,,	do	25 Sept., 1896	500			
Corowa	do	29 Oct., 1904	500 (part)	... ..	500	No Sinking Fund.
Cudgegong.....	do	13 May, 1881	1,000	.....	2,000	Sinking Fund—Estimated £200 p.a.
,,	.....	31 Dec., 1884	1,000			
Drummoyne ...	Repayment of loans raised by Municipalities of Drummoyne and Five Dock prior to amalgamation.	25 April, 1902	14,000	.....	14,000	No Sinking Fund.
Dungog	Permanent improvements.	5 Aug., 1897	500	.....	500	Sinking Fund—£50 per year.
Glen Innes.....	do	14 Feb., 1888	3,000	.....	3,000	Sinking Fund—5% p.a. from revenue.
Hurstville	Portions of debt and other liabilities due on division of Area (Bexley).	19 April, 1901	3,700	.....	4,500	Sinking Fund—2% on loans to be obtained from General Rates.
,, ...		19 April, 1901	800 overdraft			
Lismore	Permanent improvements.	16 Aug., 1880	2,000	.....	12,000	Sinking Fund—£400 p.a.
,, ...	do.	10 Oct., 1884	2,000			
,, ...	do.	30 April, 1888	2,000			
,, ...	Gas works	3 Dec., 1885	6,000			
Mittagong	Council Chambers ..	18 May, 1900	400	.....	300	No Sinking Fund; £100 to be repaid from General Fund.
Nowra.....	Conversion of overdraft.	16 July, 1907	*298/0/2	.....	298/0/2	Overdraft obtained prior to passing of Local Government Act. Proposed to repay £30 p.a. from General Fund.
Orange East ...	Temporary Loans obtained under Municipalities Act.	6 May, 1908	*380	.....	380	Repayment of Temporary Overdraft obtained prior to Local Government Act; propose to repay £50 p.a. from General Fund.
Richmond	Permanent improvements.	23 Sept., 1887	1,200	700	500	Sinking Fund to be established; £40 to £50 p.a. to be paid to same from balance of Loan Fund and General Fund.
Scone	do.	10 Oct., 1896	*204/13/8	.....	204/13/8	No Sinking Fund.
Wickham	do.	†	*1,900	.....	1,900	No Sinking Fund.
Waverley	do	14 Aug., 1868	50,000	1,000	48,750	Sinking Fund to be established. £250 to be repaid.
,, ...	do.	9 Oct., 1883				
,, ...	do.	12 April, 1886				
,, ...	do.	16 April, 1888				
,, ...	do.	30 Aug., 1890				
,, ...	do.	22 Aug., 1893				
		Totals.....	£114,882/13/10	4,150	110,282/13/10	

* The original amount of the loans cannot be quoted in these cases: the amount for which approval is now given is quoted for purpose of comparison. † Information not available.

Appendix V.

New Fixed Loans.

Municipalities.

Municipality.	Purpose of Loan.	Act under which obtained.	Date of Governor's Approval.	Amount.	Remarks.
				£	
Albury	Municipal Chambers	Municipal Loans Authorisation and Validation Act 1906, and Municipalities Act, 1897.	13 July, 1907.	4,000	
Casino	Permanent Improvements	Local Government Act, 1906 and Local Government Loans Act, 1907.	15 Oct., 1907.	5,000	Sinking Fund, £1% from rates.
			Total ...	£9,000	

Appendix VI.

Appendix VI.

Report of the Local Government Engineer for the Year ending 30th June, 1908.

Local Government has made considerable progress during the year, the Shire Councils levying and collecting their first rate revenue, after but a small percentage of reduction made on appeal against the amount of Shires assessment. On the whole the departmental estimate of the rate revenue has been exceeded, and in some instances to a very large extent. In eight shires a less rate than 1d. in the £ has been levied, but 36 Councils have levied a rate exceeding 1d. Of those 11 belong to the North Coast, where the Councils fully realised that the greater the revenue the greater the amount to be received from the Government for endowment, which latter being based on the actual receipts for rates expands accordingly, and in the cases of the Tweed, Byron, Terania, Tintenbar, Gundurimba, Kyogle, Tomki, Woodburn, Harwood, Orara, and Dorrigo Shires, where a rate of 1½d. was levied, the endowment on same amounts to no less than £58,000 in excess of the Departmental estimate for classification; so it is not surprising that whilst the latter provided for endowment to the extent of £179,135 for 87 Shires, the amount due on the rates levied will come to £221,200, a very substantial increase. In the Interim Report of the Local Government Areas Commission it was anticipated the coming into force of Shire Local Government would save the Government £65,176 per annum, but this has not occurred so far, and taking the same basis of Departmental expenditure there will be a substantial loss to the Government, for the Endowment alone will exceed the estimated amount by £42,000, whilst in addition there is the amount of Special Grants to the Shires not less than £93,000 for the year 1908, and the land tax lost is also greater than anticipated by at least £14,000. Another item of £6,200 adding to the cost to the Government is that of certain ferries and bridges made National which were included by the Commission as going over to the Shires. Altogether the Government instead of gaining by the change has lost approximately £90,000, but if the special grants be excluded there will be a very slight gain. An important factor however, in the change to local control is that more attention is paid to local wants, and improvements are affected to branch and other minor roads that the Department did not consider should be carried out at the expense of the whole State. Then again, better sanitary conditions are provided in small centres of population, and in many other ways the local knowledge and control of matters compensate for any apparent loss to the Government.

Dealing with the work done by the Councils I must bear witness to the general desire to do the best for their areas, but there is, I am afraid, a tendency to treat the main roads already constructed as being good enough, and to launch out in the making of farming or branch roads serving a few settlers and otherwise carrying little traffic. It will be a great calamity if the trunk roads are allowed to fall into disrepair, which they must do if maintenance be neglected. No doubt it is early to judge of the work done by such new bodies, but it is to be hoped they will not take a too parochial view of their responsibilities, and will deal with their areas as a whole without respect to where the revenue is obtained from, but rather as to where works are most required, having regard to the interest of the travelling public wherever they come from—it must not be overlooked the endowments were fixed on this latter principle, with the necessity for maintaining the through and trunk roads in the manner hitherto obtained under the Department.

I hardly think it would be fair to give an analysis of the expenditure of the different Councils, for there have been unusual initiative expenses of administration and getting the whole machinery into working order, so that it is scarcely surprising to find that works do not show the large percentage they should. It is hoped, however, during the current and following years there will be great expansion in works carried out and a substantial lessening of administration expenses. Regarding supervision, some Councils seem loth to go to the expense of appointing an Engineer, labouring under the fallacious idea that a handy maintenance man can do all that is wanted. In very few areas, however, will it not be found that a duly qualified Engineer is well worth his extra pay for his professional knowledge of bridges, culverts, earthwork, laying out roads, grading, surveying, supervision of contracts, and—what is perhaps more important—the proper inspection of men and seeing that they do their work properly and economically, using their heads as well as their hands. All these matters, and many more, lie with an Engineer. Regarding Shires with incomes under £3,000, it was felt a highly paid Engineer could scarcely be afforded, and so it has been decided that such should not be called upon to devote his whole services to the one Shire, and can be employed for a certain number of days in the year—this to be determined by the Minister, for, in some instances, it has been brought to the knowledge of the Department that a Consulting Engineer had been employed but two days in a year, and his appointment was really made a blind to cover the use of a ganger. This cannot be allowed, or there will be a return to the very rough work of many years back, when every Trustee posed as being a born engineer. With an income of over £3,000 a resident Engineer is imperative for one or more Shires contiguous to each other. I find, however, this dual system is scarcely a success, and although such appointments were made in many cases at the commencement of Councils' control, yet the tendency is to terminate the joint Engineer system. A difficulty in connection with Engineers is the want of training of cadets. Something should be done in the matter, and it is hoped an arrangement will be made by the University, the Government, the Public Service Board or the Councils by which some system of professional training will be adopted, so that in the future we shall not be so dependent on other States as at present for our Shire Engineers.

I have inspected various lengths of roads throughout the country, and am pleased to find the great interest taken by the different Councils in the works of their areas. Of course there is the old desire to get special grants from the Government, even by Councils with large endowments, whilst Progress Committees do not yet realise that the Shire Councils have control of works, and should be looked to instead of the Department. In many instances the local member is still made use of to bring matters of interest before the Department, but in time the functions of the Councils will be more recognised, and they will no doubt represent their own cases.

During

During the year several applications for the transfer from one Shire to another have been received, but the procedure in connection with reconstitution is slow, so that in few cases have the transfers been completed. Since the adoption of the new mode of rating on the unimproved values by Municipalities, very many petitions have been received for transfer of areas of incorporated towns to the contiguous Shires, the usual plea being the heavy rate levied by the Municipal Council as compared with that made by the Shire; it is altogether forgotten that until 1907 the Shires escaped *all taxation* (except the land tax, which was common to both towns and country), and therefore these discontented ratepayers are not being put into a worse position than they have been for many years. No doubt there are cases where the new mode of rating presses harshly, but it is impossible to frame a law that would meet all such objections, and it must not be overlooked that to greatly reduce some municipal areas would dislocate their Councils' finances considerably, although transferred areas are liable to carry their proportion of debt.

During the year just closed, Municipalities received £54,000 in special grants, of which £32,551 was for the upkeep of roads hitherto subsidised or maintained by the Department. As soon as possible a list of those Municipalities where the cost of transferred works exceeds the amount of suspended land tax will be prepared, and they will receive such endowment as may be certified to under Section 162 (4) of the Local Government Act. Respecting towns that may be termed necessitous, it is difficult to determine them, having regard to the limit of taxation allowed under the Act. Generally, Municipal Councils have levied rates that give revenue very much in excess of that previously received, but in some cases the desire to keep down the rate is evident, and the improvement or repair of their streets is allowed to suffer thereby, and this is set up as a plea for being considered necessitous. If such were conceded, it would be virtually penalising well-managed Municipalities who, whilst keeping their rates low, yet look well after their works. These latter Councils seldom apply for grants.

In my last year's report I gave statistics as to the works, roads, bridges, ferries, wharves, public watering places, etc., in both Shires and Municipalities, so there is no need to repeat the information; whilst the Government Statistician will no doubt in due time give details as to the operation of the various Municipal and Shire Councils,

Various inquiries have been held during the year in connection with applications for loans, reconstitution of areas, new municipalities and boundary works; and generally I may say the work of this branch has largely increased, whilst, with reclassification of the Shires in view at the end of 1909, it is incumbent that a far greater number of inspections must take place; and in this and the general inquiry work of the branch I am pleased to have the help of Mr. J. A. Rossbach, whose long and varied experience in the Roads Branch and his knowledge of the country districts enables him to give valuable and effective assistance.

ROBERT E. JONES,
Local Government Engineer.

10th October, 1908.

National Works, Closer Settlement and Tourist Roads and Roads, Bridges, Ferries, and Public Watering Places in the Western Division.

30th October, 1908.

I have the honor to submit the following report on the work carried out under the above heading during the year which closed 30th June, 1908.

The total expenditure amounted to about £165,789, made up as follows :—

	£	s.	d.
Bridges.—New works	34,761	0	0
Maintenance	19,458	0	0
Roads.—Tourist and others	57,190	0	0
Closer settlement	8,739	0	0*
Construction and Maintenance (Western Division)	9,961	0	0
Completion of contracts, unfinished when Shires took control, etc....	21,697	0	0
Ferries.—Maintenance	12,724	0	0
Public Watering Places.—Caretaking only	1,259	0	0
Total	£165,789	0	0

Work on the bridges which were under construction at close of the preceding year has, with one exception, been proceeding satisfactorily, any delays which occurred being principally due to difficulty in procuring timber. At Pallamallawa, where a composite truss bridge was being constructed over the Gwydir River, floods occurred at a critical time, the bottom chords of truss having been just placed in position and riveted. The bridge escaped damage, but the whole of the temporary staging was washed away. At Oyster Channel, the exception above referred to, work has been very slow, but in May the contractors made satisfactory arrangements for completion of the work, and at time of writing the bridge has been opened for traffic.

Tenders were accepted during the year for nine new bridges, representing a total value, as under, of £28,070.†

Bridge.	Stream.	Contract Price. £	s.	d.	Description.
Casino	Richmond River	9,235	0	0	One steel truss, 154 feet span, and eight timber beam spans.
Howlong	Murray River	4,200	0	0	One composite truss, 105 feet span, bottom chords steel, and six timber beam spans.
Upper Ash Island	Hunter River	3,225	0	0	Fourteen timber beam spans, 12 of 45 feet, and two of 35 feet each.
Briner	Upper Coldstream	2,928	1	5	One composite truss, 91 feet span, and eight timber beam spans.
Gundy	Page River	2,883	0	0	One composite truss, 104 feet span, and five timber beam spans.
Skidmore's	Muddy Creek	1,993	12	4	Rolled steel girders, iron buckle plate deck covered with tarred metal.
Walcha	Apsley River	1,370	0	0	Six timber beam spans, 191 feet overall.
Quondong	Stephen's Creek	1,365	15	6	Seven timber beam spans, 213 feet overall.
Hospital Creek	Hospital Creek	870	0	0	Four timber beam spans, 103 feet overall.

In addition to the above new work, a tender at £3,795 was accepted for alterations to the existing road and railway bridge over the Nepean River at Penrith. When the new railway bridge was completed in June, 1907, the section of the old bridge which had previously carried the railway was handed over to this Department for conversion to purposes of road traffic. After careful examination and the consideration of alternative schemes, it was decided to increase the roadway to 20 feet 1½ inch, and provide a footpath about 5 feet wide, the new deck to be of reinforced concrete covered with tarred metal. As the width formerly available for vehicular traffic was only 6½ feet, the relief afforded by the alterations which are now nearing completion will be very great.

Tenders had also been invited and plans were in hand for eight other new bridges estimated to cost about £26,983. The most important of these is the proposed high-level bridge at Scabbing Flat on the Macquarie River intended to replace the existing low-level structure. The new bridge will include two composite truss spans of 90 feet each on either iron cylinders or timber piers with concrete bases, the cost being estimated at £9,500 and £7,600 respectively. Following this is the proposed bascule bridge at Swansea, Lake Macquarie, estimated to cost £6,180, which will replace the present drawbridge. The opening in the existing bridge, which was originally in use at Blackwattle Bay, Sydney, is about 30 feet. In view of the increasing traffic on the lake the new bridge is designed to provide a clear width of 41 feet. The estimated costs of the other proposed bridges range from £630 to £2,860.

Preliminary information and estimates were furnished and construction approved of seven additional structures, the total estimated cost being £17,950.

Survey

* This amount includes expenditure made from funds provided by the Department of Lands. † The amounts quoted in this report are, with the exception of those in the tabulated bridge Statement, to the nearest £.

Survey is also being made and statistical and other information being obtained in connection with a proposal for bridging the Murray River, alternative sites being suggested at Towong and Bringenbrong. Information is also being obtained for a proposed bridge over the Wakool River, on the road from Balranald to Swan Hill, and boring to test the foundations is being done by contract, under close supervision.

It will be seen from the amount expended, that special attention has been given to maintenance; but although the expenditure under this head has been comparatively large, great care has been exercised that none but urgent or necessary work was undertaken, and that due regard was had to economy. In the case of the Denman Bridge over the Hunter River, where the decking was very much worn and renewal at a heavy cost appeared necessary, it was decided, after a special examination had been made, to lay 1½in. hardwood sheathing diagonally on the old deck, the inequalities on the latter being first taken up by a coating of fine asphalt. The work was carried out by day labour at a comparatively small cost, and after several months has shown excellent results.

The sweeping and cleaning of the National bridges is now done by contract, the maintenance men who formerly did the work being no longer available. In most cases an agreement is entered into with a near-by resident, who for a small sum monthly does what is required, and reports to the District Officer when any matter needs his attention. This method, which is an inexpensive one, has been found so far to work very satisfactorily.

The expenditure made upon Closer Settlement roads—viz., £8,739—is hardly a sufficient index to the amount of work carried out; for, in addition to construction, a very large amount of grading and exploratory work was undertaken. At the Dorrigo about 40 miles of new roads were laid out, and a similar total length on the scattered areas in the Tweed district. A further examination, involving about 24 miles of new grading, was also made of the proposed route from Kyogle to Tooloom, with the result that a more suitable and less costly, though somewhat longer, line was found. In this connection valuable assistance was afforded by the Kyogle Shire Engineer, Mr. R. C. Braithwaite. Unexpected opposition was met with from some of the residents on the Dorrigo subdivisions, who refused to allow work on their blocks to proceed until the land required for the graded roads had been resumed. This action had the effect of holding up for a time the opening of about 16 miles of new road.

The tourist road from Jindabyne to Kosciusko, where owing to the frequent and heavy snowfalls, work can proceed during only the summer months, was practically completed, and a good route is now available for vehicular and motor traffic to the summit, about 31¼ miles from Jindabyne. A bridle track which forms a loop about 8 miles in length, commencing at the summit and returning to the main road at Charlotte's Pass, 4½ miles lower down, provides access to the Blue Lake and other points of interest.

Of the 201 Public Watering Places in the Western Division, 101 are leased for sums which vary from 1s. to £151 a year, representing a total rental of about £2,351. Forty-five are worked under agreement at rates varying from £1 to £60 a year, the total subsidy amounting to £1,259. The Leases usually run for periods of five years, the Agreements for three, and both are the results of public tendering. The remaining 55 are either open watering-places or have been recently proclaimed, and a tenancy not yet arranged.

The National Ferries, of which there are now eleven, have been added to by the proclamation of the Coraki Ferry, formerly worked by the Municipal Council. It being considered that the present hand punt, which is fitted with an oil engine, is insufficient to meet the growing requirements of traffic here approval was given for the provision of a new punt, of the ordinary type, worked by steam, and a tender for its construction was accepted in March, 1908; cost, £1,825. It will, it is anticipated, be placed in commission in December.

W. J. HANNA,
Under Secretary.

Government Dockyard, Biloela.

Report of Managing Committee for year ended 30th June, 1908.

We have the honor to submit the following report covering the operations of the Government Dockyard for the year ended 30th June, 1908.

A reference to the attached returns will show that the volume of work has very largely increased during the past twelve months, and, on glancing at the figures for 1905–6, it will be found that the turnover during that period has been doubled in the year under review; in fact, it has been on the upward grade since the inauguration of the Managing Committee. The total turnover for last year amounted to £72,579 5s., whereas for the previous year (1906–7) the amount was £50,688 4s.

We have pleasure in stating that during the year many permanent improvements have been carried out; including the completion of coppersmiths' shop, 50-ton shearlegs, 500-ton slip, and 300-ton flange press; the construction of a building slip, with capacity for vessels up to 400 ft. long and 60 ft. beam; also a small steel foundry almost completed.

It is gratifying to be able to state that the works have been kept well occupied, and this can be readily understood when it is pointed out that the average number of men employed on the Island showed an increase from 295 during 1906–7 to 400 last year. But with the improvements made from time to time, which all tend to the economical and expeditious turning out of the work, a greater volume than passed through our hands last year could, with safety, have been entrusted to the Dock establishment.

Amongst the most important works effected during the year might be mentioned the conversion of the dredge "Jupiter" from a suction-pump dredge, without separate pumping engines, to a self-propelling sand-pump dredge with independent pumping plant. The total cost of this work amounted to £13,685 and when complete it will be of a very satisfactory nature.

Another important undertaking entrusted to the Managing Committee is the construction of the Fisheries Investigation vessel for the Federal Government. With the approval of the Minister for Works, a contract was entered into with the Federal Government; and up to the end of June very satisfactory progress had been made, especially in view of the fact that a great deal of the material required had to be imported. The keel was laid on the 1st June and by the end of that month nearly the whole of the plating was completed.

A 600-ton hopper barge was built from designs furnished by the Department of Public Works and was carried out very successfully; this punt differing from the general design on account of the introduction of hydraulic lifting gear to lift the hopper doors in place, instead of the ordinary mechanical contrivances.

During the year various orders have been placed with the Government Dockyard, among them being the manufacture of points and crossings required for the Government Railways and Tramways now in course of construction, and the Managing Committee are satisfied that this work is being turned out in a most economical manner, and the price will be found satisfactory to the Department of Public Works.

Another work of considerable importance was the alteration of the rock excavator "Poseidon" into a sand-pump dredge. This work when completed will involve an expenditure of upwards of £6,000 and should prove a very powerful sand-pump dredge and therefore of great value to the Harbour Trust.

The construction of 250-ton punt for the Harbour Trust has also been proceeded with.

On reference to the list, it will be seen that in almost all the Departments of the State and Commonwealth a considerable increase has taken place in the amount of work entrusted to the Dockyard.

The amount of docking—which is practically confined to His Majesty's Navy, together with the various vessels of the State and Commonwealth Governments—amount to 90,194 tons; being almost the same as for the previous year. If the authorised dues had been chargeable, the receipts would have totalled £14,620; but with the exception of dues received from merchant vessels, practically the only charges made are those covering the actual cost of the work, together with the maintenance of the establishment; consequently, the actual receipts from docking only amounted to £913 13s. 11d.

The total expenditure of the Dredge Service during the year was £27,408 7s. 7d., but after deducting the cost of the work involved in connection with the conversion of the dredge "Jupiter" and the construction of the 600-ton punt, it will be observed that the amount for repairs to dredges has been materially reduced. This is probably owing to a great deal of this work being done at the Newcastle workshops.

It would appear that the usefulness of the establishment will be maintained during the ensuing year, as there is upwards of £70,000 worth of work in hand at the present time; and the Committee feel justified in expecting that the present turn-over will at least be maintained, as year after year it has hitherto increased; and, moreover, we consider that the work as a whole has been of a very satisfactory character and that, with the improvements in progress for the economic working of the establishment, the turnover could be almost double before the works would be fully occupied.

The Committee desire to place on record their appreciation of the valuable assistance rended by the Dockyard Officers in the performance of their various duties.

ROBT. HICKSON, M. Inst. C. E., Chairman.
W. J. HANNA.
E. M. de BURGH, M. Inst. C. E.
A. E. CUTLER, Assoc. M. Inst. C.E., M.I.M.E.,
Superintendent.

"A."

STATEMENT showing Actual and Estimated Receipts and Expenditure for year ended 30th June, 1908.

ACTUAL RECEIPTS.

Particulars.	£ s. d.	£ s. d.	£ s. d.
ocking Charges—			
Merchant vessels		798 14 4	
epairing Men-of-war, &c.—			
Actual cost.....	715 1 2		
Ten per cent. charged		71 10 1	
epairing Commonwealth vessels—			
Contracts	340 15 10		
Balance Profit and Loss Account.....		40 2 6	
Not Contracts.....	51 11 2		
Ten per. cent. charged		5 3 0	
iscellaneous Tests, &c.	21 19 0		
Percentage charged		4 3 11	
se of plant and dock gear	66 19 10		
se of Electric Light	232 10 0		
" " Power	50 19 9		
		350 9 7	
iscellaneous Receipts—			
Ingot metal, &c....	605 12 10		
Scrap-iron, &c. ...	75 0 9		
Use of "Cyclops" (lighter)	140 7 0		
Use of "Ruby" (launch)	127 6 4		
Other receipts ...	67 5 7		
		1,015 12 6	
			2,285 15 11

ESTIMATED RECEIPTS.

ocking Charges—			
Dues if chargeable)			
Men-of-war	6,386 13 4		
Commonwealth vessels	225 0 0		
State vessels	7,220 0 0		
		13,831 13 4	
Works carried out—			
Public Works Department	37,364 1 4		
Other Departments	23,611 6 5		
Estimated profit, 10 per cent. on	60,975 7 9	6,097 10 9	
		19,929 4 1	
			£22,215 0 0

ACTUAL EXPENDITURE.

Particulars.	£ s. d.	£ s. d.	£ s. d.
Expenses in Docking—			
Merchant ships	130 3 11		
Men-of-war	376 1 10		
Commonwealth vessels (material only)	3 11 5		
State vessels (material only)	142 2 4		
		651 19 6	
Pumping Station—Maintenance, &c.		256 13 2	
Maintenance and Repairs—			
Boiler shop..... ..	263 1 4		
Machine shop.....	205 6 0		
Blacksmiths' shop	210 14 4		
Pattern shop and Foundry	22 9 10		
Sawmill and carpenters' shop	89 1 2		
Power house and Elec. plant	510 12 8		
Bolt and Spike Shop...	61 11 9		
Fitting shop	67 11 4		
		1,430 8	
Docks Maintenance—			
Fitzroy Dock	56 15 5		
Sutherland Dock	156 3 9		
Travelling Cranes	65 1 7		
		278 0 9	
Electric Light—			
Maintenance and repairs ...	44 6 11		
Vessels use	149 9 10		
		193 16 9	

Launches, &c.—

	Working Expenses.	Repairs.	
	£ s. d.	£ s. d.	
"Ruby"...	465 7 7	96 12 9	562 0 4
"Cyclops"	229 4 5	29 18 9	259 3 2
Wooden Punt			45 10 8
Iron Hopper Punt.....			20 8 9
Iron Reclamation Punt			21 14 7
			908 17 6

Miscellaneous expenses—			
Office, Store, &c.	248 17 4		
Quarters	29 8 11		
Yard and General Works...	667 16 9		
Holidays	1,097 15 1		
		2,043 18 1	
			5,763 14 2
Working up Material	231 9 4		
Labour, &c., in docking—			
Commonwealth vessels	5 15 5		
State vessels	200 13 2		
		437 17 11	
Salaries of permanent officers and foremen		2,860 18 10 3,298 16 9	
			9,762 10 11
Balance			13,152 9 1
			£22,215 0 0

"B."

Dock Establishment Vote for year ended 30th June, 1908.

Particulars.	Amount. £ s. d.	Amount. £ s. d.	Amount. £ s. d.
Pumping Station—			
Machinery	171 19 8		
Boilers	70 19 2		
Maintenance, &c.	13 14 4		
		256 13 2	
Docks' Maintenance and Repairs—			
Fitzroy Dock	56 15 5		
Sutherland Dock	156 3 9		
Travelling Cranes	65 1 7		
		278 0 9	
Docking of Vessels—			
Fitzroy Dock	190 8 3		
Sutherland Dock	461 11 3		
		651 19 6	
Electric Light—			
Maintenance and Repairs	44 6 11		
Vessel's use	149 9 10		
		193 16 9	
Ships' Maintenance—			
Carpenters' Shop and Sawmill	89 1 2		
Machine Shop	205 6 0		
Bolt and Spike Shop	61 11 9		
Fitting Shop	67 11 4		
Power House and Electric Plant	510 12 8		
Boiler Shop	263 1 4		
Pattern Shop and Moulders' Shop	22 9 10		
Blacksmiths' Shop	210 14 4		
		1,430 8 5	
Miscellaneous Expenses—			
Yard, Quarry, and General Works	667 16 9		
Office and Store	248 17 4		
Holidays	1,097 15 1		
Officers' Quarters	29 8 11		
		2,043 18 1	
Launch, Lighter, Punts, &c.—			
"Ruby"—Repairs, &c.	96 12 9		
„ Working Expenses (driving, &c.)	465 7 7		
		562 0 4	
"Cyclops"—Repairs, &c.	29 18 9		
„ Working Expenses (driving, &c.)	229 4 5		
		259 3 2	
Dock's Wooden Punt—Overhaul and Repairs	45 10 8		
„ Iron Hopper Punt	20 8 9		
„ Iron Reclamation Punt	21 14 7		
		87 14 0	
			5,763 14 2
Permanent Improvements.			
Excavation of Rock		324 8 10	
Small Building Slip		438 19 0	
Fire Appliances		8 2 0	
Cranes, Tram-lines, &c.		440 2 5	
			1,211 12 3
			£6,975 6 5

"C."

Extensions and Alterations for year ended 30th June, 1908.

Particulars.	Amount. £ s. d.	Total. £ s. d.
Construction of large (500-ton) Slip	1,541 4 0	
Walls in connection with Fitzroy Dock	135 15 9	
Construction of New Shear-legs	1,121 18 9	
Part Manufacture of large (300-ton) Flanging Press	127 10 7	
Part Extension to Fitzroy Shop	309 10 5	
Part Extension to Machine Shop	239 9 6	
Part Construction of new Steel Foundry	363 15 8	
Extensions of Wharves	35 5 0	
Part Construction of new Coppersmiths' Shop	177 7 5	
Labour-saving Appliances	82 1 3	
		£4,133 18 4

"D."

"D."

STATEMENT showing Expenditure during year ending 30th June, 1908.

Service.	Expenditure.	Proportion of Expenditure as compared with Total Expenditure.	
		Excluding Dockyard Works.	Including Dockyard Works.
	£ s. d.	per cent.	per cent.
Dredge Services	27,408 7 7	44·950	37·763
Harbours and Rivers	569 17 5	·935	·785
Roads and Bridges, Punts and Ferries, &c.	366 7 5	·601	·505
Railways and Tramways	6,648 16 5	10 904	9·160
Water Supply and Drainage	1,726 8 3	2·831	2·379
Miscellaneous (Public Works Department)	644 4 3	1·056	·888
Total of Works Department (excluding Dockyard)	37,364 1 4	61·277	51 480
Instruction Department	1,731 15 8	2·840	2·386
Government Printing Office	223 14 5	·367	·308
Police and Prisons Department	342 2 1	·561	·471
Navigation Department	2,772 16 1	4·548	3 ·821
Sydney Harbour Trust	12,581 13 6	20 634	17 335
Agriculture Department	103 15 3	·170	·143
Explosives Department	336 5 3	·552	·463
Public Health Department	224 10 8	·368	·309
Commonwealth Department	4,165 10 11	6·832	5·739
Stores Supply and Tender Board	363 0 9	·595	·500
Lunacy and Asylums	14 3 11	·023	·019
Intelligence Department	14 17 9	·024	·021
Repairing Men-of-war, &c.	715 1 2	1·173	·985
Miscellaneous Services	21 19 0	·036	·030
£	60,975 7 9	.....	.....
Dockyard Extensions	4,133 18 4	.....	5·697
Dockyard Contingencies	6,975 6 5	.....	9·611
Dockyard Store Advance Account	494 12 6	.....	·682
£	72,579 5 0	100·000	100·000

"E."

STATEMENT of Docking Operations for the year ended 30th June, 1908.

Fitzroy Dock.

Class.	Vessels.		Receipts.			Expenditure.	
	No.	Tonnage.	Total.	Excess over Expenditure.	If dues chargeable in all cases.	Total.	Per ton.
			£ s. d.	£ s. d.	£ s. d.	£ s. d.	d.
Merchant Vessels	1	1,123	30 4 2	14 3 1	30 4 2	16 1 1	3·4309
Men-of-War	3	4,335	86 10 2	19 4 7	342 19 2	67 5 7	3·7241
Commonwealth and State Vessels	43	8,683	264 12 5	.....	5,855 0 0	264 12 5	7·3141
Totals	47	14,141	381 6 9	33 7 8	6,228 3 4	347 19 1	5·9054

Sutherland Dock.

Class.	Vessels.		Receipts.			Expenditure.	
	No.	Tonnage.	Total.	Excess over Expenditure.	If dues chargeable in all cases.	Total.	Per ton.
			£ s. d.	£ s. d.	£ s. d.	£ s. d.	d.
Merchant Vessels	8	28,888	768 10 2	654 7 4	768 10 2	114 2 10	·9482
Men-of-War	12	43,155	559 13 11	250 17 8	6,043 14 2	308 16 3	1·7174
Commonwealth and State Vessels	12	4,010	87 9 11	.....	1,590 0 0	87 9 11	5·2366
Totals	32	76,053	1,415 14 0	905 5 0	8,402 4 4	510 9 0	1·6108

Totals.

Class.	Vessels.		Receipts.			Expenditure.	
	No.	Tonnage.	Total.	Excess over Expenditure.	If dues chargeable in all cases.	Total.	Per ton.
			£ s. d.	£ s. d.	£ s. d.	£ s. d.	d.
Merchant Vessels	9	30,011	798 14 4	668 10 5	798 14 4	130 3 11	1·0411
Men-of-War	15	47,490	646 4 1	270 2 3	6,386 13 4	376 1 10	1·9006
Commonwealth and State Vessels	55	12,693	352 2 4	.....	7,445 0 0	352 2 4	6·6578
Totals	79	90,194	1,797 0 9	938 12 8	14,630 7 8	858 8 1	2·2841

"F."

STATEMENT showing comparison between Expenditure during the years 1907–8 and 1906–7.

Service.	Expenditure.	
	1906–7.	1907–8.
	£ s. d.	£ s. d.
Dredge Service	24,845 15 6	27,408 7 7
Harbours and Rivers	588 11 9	569 17 5
Roads, Bridges, Punts and Ferries	470 8 7	366 7 5
Railways and Tramways	1,426 13 5	6,648 16 5
Water Supply and Drainage	402 12 10	1,726 8 3
Miscellaneous, Public Works Department	700 0 4	644 4 3
Total of Works Department (excluding Dockyard)	28,434 2 5	37,364 1 4
Instruction Department	3,074 2 8	1,731 15 8
Government Printing Office	172 15 3	223 14 5
Police and Prisons Department	317 19 9	342 2 1
Navigation Department	2,890 1 4	2,772 16 1
Sydney Harbour Trust	3,177 12 3	12,581 13 6
Agricultural Department	107 18 10	103 15 3
Explosives Department	549 6 5	336 5 3
Public Health Department	293 12 5	224 10 8
Commonwealth Department	438 12 11	4,165 10 11
Metropolitan Board of Water Supply and Sewerage	129 18 5	.....
Stores Supply and Tender Board	74 5 8	363 0 9
Lunacy and Asylums	.....	14 3 11
Intelligence Department	.....	14 17 9
Repairing Men-of-war, &c.	380 6 11	715 1 2
Miscellaneous Services	17 5 11	21 19 0
	40,058 1 2	60,975 7 9
Dockyard Extensions	4,353 3 9	4,133 18 4
,, Contingencies	5,975 1 2	6,975 6 5
,, Store Advance Account	301 17 11	494 12 6
Totals	50,688 4 0	72,579 5 0

Report

Report of the Government Land Valuer.

I HAVE the honor to submit a *précis* of the work passing through this Branch during the past twelve months ending 30th June last.

The year has been a busy one, as several City Tramway extensions have been acquired, while the preliminary work for the resumption of the lands required along the North Coast Railway Route has engrossed attention.

Now that the Reservoir at Barren Jack is being prepared to receive the foundations, and a start will shortly be made with the dam, the acquisition of the submerged area is being looked into, and two camps of Surveyors have been for months past working the boundaries of H.W. Level. Before a decision is come to as to what proportion of each holding will be resumed, the question of road access round the lake must be closely determined.

At the request of the Department of Lands, I superintended, with the assistance of the District Survey Office, the conduct of the Peel River Estate inquiry before the Land Court, which occupied in all about three months.

The Government Architect and myself, acting as joint Valuers for the State in the matter of Transferred Properties, have had many conferences with the Federal Officers, and have brought the work very nearly to an issue. The diversity of property taken over—comprising Land, Buildings, Armaments, Ammunition, Technical Stores of the Electric Telegraph Department, &c.—has entailed a vast amount of clerical research, occupying much time, while the legal points that have cropped up have been innumerable. We hope during the next six months to bring the whole matter to a satisfactory conclusion, and that the whole of the States will have come into line.

During my absence on leave for the last quarter of the year, the Assistant Land Valuer, Mr. W. E. Tunks, acted as *locum tenens*, and gave general satisfaction to the Department and public.

Notifications of resumption have been issued in respect of the following works :—

Bores.—Bugilbone, Boronga, Boobora, Boroma, Coolleearlee, Drildool, Merrigal, Talmoi, Tyreel, and Weetaliba.
Reservoirs.—Barren Jack, Newcastle Obelisk.
Irrigation.—Murrumbidgee Northern.
Sewerage.—Bexley.
Railways.—Belmore to Chapel-road, Gundagai to Tumut, Narrabri to Walgett, Mudgee to Dunedoo.
Tramways.—East to West Maitland.
Water Supply.—Gundagai, Katoomba, Medlow Bath, Port Kembla, Wellington.
Timber Depôt.—Irvington.
Reclamation.—Kogarah Bay.
Roads.—Manly, Sutherland.
Asylum.—Newington.
Stormwater Channels.—Rookwood, Stanmore-road.
Police Paddock.—Ugarie.
Experimental Farm.—Yanco.

Lands Purchased for undermentioned Works.

Tramway.—Bellevue Hill.
Fire Brigade Stations.—Richmond, Enfield, Five Dock, Surry Hills, Strathfield, Drummoyne, Kensington.
Police Stations.—Hurstville, Pymble.
Stormwater Channel—White Bay.
Hospital for Insane—Parramatta.

Tramways Proclaimed and Confirmed.

Addison-road to Dulwich Hill, Lillie Bridge to Balmain-road, *via* Booth-street, East to West Maitland, George-street to Erskineville, Watson Bay Tramway (Extension to Clovelly Park), Bellevue Hill Deviation, High-street to West Maitland Railway-station, Willoughby Terminus to Chatswood Railway-station, Lillie Bridge to Balmain, Part 2, Crown street, *via* Baptist-street, to Phillip-street, Henderson-road Extension, *via* Railway-parade, Queen-street to Waverley Depôt, Arncliffe Railway-station to Bexley, Gore Hill to Burns' Bay road.

Railways.

Belmore to Chapel road, Narrabri to Walgett (Deviation), Mudgee to Dunedoo, Parts 1 and 2, Maitland to South Grafton, Parts 1 and 2.

Eighty-seven cases standing over from previous years have been finally settled ; 139 Valuations in various parts of the State have been made ; and 178 cases were advanced to a stage for valuation.

EDWARD J. SIEVERS,
Government Land Valuer.

Under Secretary for Public Works,
25th September, 1908.

Engineering Drawing Office and Ironwork Inspection.

THE past year has been a very busy one. Irrespective of sketches and estimates of a preliminary character, designs were prepared for works for which tenders were advertised, or which were put in hand by day-labour, as under :—

	£	s.	d.
Rivers, Water Supply, and Drainage Branch	156,529	2	9
Railway and Tramway Construction Branch	651,539	2	8
Roads, Bridges and Public Watering Places Branch	32,484	8	4
Quotations for minor works	3,654	1	0
Total	£844,206	14	9

On 30th June, 1906, the staff consisted of twenty-five draftsmen ; on 30th June, 1907, of forty-six draftsmen ; and on 30th June, 1908, of twenty six permanent draftsmen (including Mr. Hodgson on leave prior to retirement), twenty-seven temporary draftsmen, and four cadets, or 57 in all. The total amount of salaries paid to draftsmen and cadets was £11,019, which, allowing for one-half of my own salary against design work (the balance against ironwork inspection and other duties), makes a total of £11,274, as the cost of salaries in connection with designs, preliminary sketches and estimates, and work of a miscellaneous character.

Percentage Cost of Office.

Taking, as in past years, the work actually carried out (*i.e.*, Contract work) as a basis, the percentage of cost for designs has been as under :—

	1904-5.	1905-6.	1906-7.	1907-8.
	£	£	£	£ s. d.
Estimated value of Contract work	239,365	481,265	465,766	844,206 14 9
Amount of salaries of designing officers	5,170	5,725	6,712	11,274 0 0
	per cent.	per cent.	per cent.	per cent.
Percentage of cost of salaries on value of Contract work	2·16	1·19	1·44	1·34

The above figures do not take account of Barren Jack Dam and other works for which portion of the plans have been prepared, but which had not been sent out for tender before the close of the financial year.

In connection with preliminary schemes may be noted the Sydney and North Sydney Connection. Revised estimates for Bridge schemes, and plans and estimates for Tunnel schemes, were being investigated at the request of the Royal Commission dealing with this matter, at the close of the financial year.

Inspection of Ironwork.

During the year contracts were let for the manufacture of the steel bridges required for the first section of the North Coast Railway. The construction was also commenced of the steam punt for Coraki, which is being supervised from this office. In consequence of the number of contracts in hand, it has been necessary to appoint another inspector in connection with the supervision of ironwork for the Railway and Tramway Construction Branch. At the end of the year there were 3 permanent and 3 temporary inspectors of ironwork employed under my charge, in addition to the Lithgow staff.

At Messrs. G. and C. Hoskins' foundry the quantity of material inspected amounted to 5,715 tons, valued at £51,104, as against 3,523 tons, valued at £30,796, during the preceding year. The cost of inspection of this material was 1·06 per cent.

Great care has been exercised to ensure that iron and steel obtained from Lithgow was used in all contracts.

Custody of Plans.

During the year 2,030 plans and 332 field books were registered. In January last the Plan Room was removed to the ground floor, adjacent to the Railway Construction Plan Room, which is a more convenient and compact arrangement.

STEEL AND IRON CONTRACT.

Mr. W. F. Burrow, Testing Engineer, reports as follows :—

Since the first report, dated 30th June, 1907, which covered a period of six months only, a great advance has been made in the output under this contract, notwithstanding many stoppages and an entire change in the management of the Eskbank Rolling Mills.

General Output.—The returns for the six months ending 30th June, 1907, showed an output value of only £17,641 5s. 4d.

The total value of the material supplied during the twelve months ending 30th June, 1908, as shown in detail on the attached table, amounted to £118,744 5s. 1d., of which £76,064 0s. 11d. was supplied direct to the Government, Railway Commissioners, and the Sydney Harbour Trust, and £42,683 4s. 2d. was supplied to contractors for works carried out under various Government Departments.

Staff and Office Routine.—The staff on 30th June, 1907, consisted of the Testing Engineer, Mr. W. F. Burrow, two Inspectors, and one Clerk.

Since that date the Testing Office has been remodelled, and machinery and plant installed for the preparation of test specimens, and the making of forge and other tests.

A description of this machinery and the appliances for testing is given in the Paper on the "Commercial Testing of Steel and Iron," prepared by the Testing Engineer.

The staff now consists of the Testing Engineer, three Inspectors, one Labourer (branding), one Machinist, two Clerks, and one Lad.

During

During the early part of the Contract the material was forwarded direct, and the freight paid by the Contracting Company, but delivery is now accepted "On Trucks, Eskbank."

This has involved a considerable amount of clerical labour, but is a more satisfactory system.

The forwarding of material has entailed, *inter alia*, the preparation and signing of the following:—1,376 Railway Consignment Notes in duplicate, 2,161 Inspectors' Certificates (duplicate) of material passed, 1,939 Forwarding or Advice Notes in duplicate and triplicate, 1,133 Vouchers passed for payment.

Testing Room.—The following tests have been made during the year, covered by test certificates:—525 machine tests (tensile), 353 forge tests in conjunction with machine tests, 321 complete forge tests in addition to above on which alone material has been passed.

Careful card records are kept of all tests made, and stored at the end of each six months.

At any future time it will be possible to turn up a card and give a complete history of all material sent away. In the case of steel, it is generally possible to supply the analysis; at any rate, the carbon contents.

Progress of the Steel and Iron Works—The whole of the ironworks, including the blast furnace, was taken over by Messrs. G. and C. Hoskins, Limited, on 31st December, 1907. Since that date the old works have been largely remodelled. New foundations have been put in under most of the engines and rolling mills, large drains have been cut, new weighing machines and alligator shears installed, together with hydraulic cranes, new boilers, and high-pressure steam pipes.

New stock-sheds have also been erected, and greatly improved transit facilities put in. The new 24-inch mill has been provided with a modern reversing engine, now nearing completion.

Cost of Supervision—The cost of inspecting, testing and forwarding as outlined, for the twelve months ending 30th June, 1908, based on the salaries paid, amounted to 1·09 per cent. on the value of material forwarded. For the first twelve months of the contract, ending 31st December, 1907, the cost amounted to 1·02 per cent. on the output value. If to this sum is added the cost of preparing test specimens paid to the contractors, and testing done at the University prior to the installation of machinery in the Testing Office, the cost becomes 1·20 per cent. on the value.

For the month of June, 1908, when the preparation of test specimens was done by the Testing Office staff, the cost of supervision, including the wages of machinists, amounted to 1·30 per cent. on the output value. It must be pointed out that during this month, the sheet and galvanised iron mills were closed.

With a very small addition to the wages expenditure, the staff is capable of handling a much greater output, and it is estimated that a direct saving of about £300 per annum will be made by the introduction of machinery into the Testing Office for the preparation of test specimens.

Total value of material supplied to all Government Departments for twelve months ending 30th June, 1908:—

Supplied direct to:—			
Government Departments	£11,107 19 1		
Railway Commissioners	31,595 16 1		
Sydney Harbour Trust	2,189 19 10		
		£44,893	15 0
Supplied to contractors under:—			
Government	£23,766 10 6		
Railways	18,399 16 1		
Sydney Harbour Trust	513 17 7		
		£42,680	4 2
Railway construction and other material not in Contract, as supplied to:—			
Government Departments	£9,369 16 2		
Railway Commissioners	21,800 9 9		
		£31,170	5 11
		£118,744	5 1

In addition to the above, scrap iron, amounting to 10,326 tons, received from the railways, has been inspected and classified.

H. H. DARE,
Assistant Engineer.

* List No. 1.

ROADS, BRIDGES, AND PUBLIC WATERING PLACES BRANCH—CONTRACT WORK.

		£	s.	d.
1.	Bridge over Stephen's Creek, at Quondong	1,365	15	6
2.	,, ,, Apsley River, at Walcha	1,370	0	0
3.	,, ,, Nepean River, at Penrith—reconstruction ...	3,578	16	6
4.	,, ,, Hospital Creek...	870	0	0
5.	,, ,, Page River, at Gundy...	2,883	0	0
6.	,, ,, Burrangong Creek, in Young...	520	0	0
7.	,, ,, Bogan River, at Marra Crossing	365	0	0
8.	,, ,, Fawcett Creek, at Kyogle	1,375	17	2
9.	,, ,, M'Intyre River, at Tingha Crossing—raising	299	0	0
10.	,, ,, Lachlan River, at Warroo	2,272	13	6
11.	,, ,, Hunter River, at Ash Island...	3,225	0	0
12.	,, ,, Macquarie River, at Warren	2,190	10	6
13.	,, ,, Lake Macquarie, at Swansea	6,180	0	0
14.	,, ,, Merimbula Lake	1,493	17	0
15.	,, ,, Nowra Bridge—painting	469	18	2
16.	,, ,, Orphan School Creek—reconstruction ...	300	0	0
17.	,, ,, Coraki Steam Punt	1,825	0	0
18.	,, ,, 20 Buckled Plate Tanks	1,900	0	0
		£32,484	8	4

* NOTE.—These lists represent the value of works as taken in the Drawing Office returns, and should not be confused with the Accountant's statement. They include only such works as were sent on for Tender or put in hand by Day Labour.

List No. 2.

List No. 2.

RIVERS, WATER SUPPLY, AND DRAINAGE BRANCH.

No.	Name of Work.	Cost. £	s.	d.
1.	Wharf, near Merewether-street, Newcastle	14,732	1	0
2.	„ at Tathra—Goods-shed and Stock-yard	1,482	0	0
3.	Jetty at Port Kembla	13,731	0	0
4.	„ Woolgoolga—Erection of 7½ ton Crane	620	11	9
5.	„ Woolgoolga—Repairs	1,300	0	0
6.	Coff's Harbour—Goods-shed, &c.	1,177	0	0
7.	„ „ New Trucks	130	0	0
8.	„ „ Repairs and Landing Stage	929	11	5
9.	Sea Wall and Shed at Merimbula	1,565	0	0
10.	Deepening Channel, Camden Haven River, at Kendall ...	36	12	5
11.	Dredge "Zeta"—Conversion	4,500	0	0
12.	„ "Groper"—Alterations	250	0	0
13.	„ "Tethys" and "Antleon"—Alterations	320	0	0
14.	„ "Glacus"—Trunnion Pipe	45	0	0
15.	„ Portable for Wyong Creek	1,000	0	0
16.	Water Supply for Gundagai	8,650	0	0
17.	„ „ Wollongong—Extensions	312	18	9
18.	„ „ Walgett	92	0	0
19.	„ „ Morriset	2,971	2	7
20.	„ „ Wellington	9,670	0	0
21.	„ „ Mittagong	9,700	0	0
22.	„ „ Murwillumbah	2,305	0	0
23.	„ „ Lismore—Additions	2,470	0	0
24.	„ „ Jenolan Caves—Electric Lighting ...	1,900	0	0
25.	Sewerage of Newcastle—Ventilation, first Section ...	1,593	18	5
26.	„ „ „ Ventilation, second Section ...	1,200	0	0
27.	„ „ „ Low level, first division ...	12,088	2	0
28.	„ „ Iron Cove—Low Level	4,314	17	11
29.	Swamp Drainage at Black's Swamp	843	0	0
30.	„ „ „ Terragong Swamp—Additions ...	350	0	0
31.	„ „ „ North Casino	4,256	3	0
32.	„ „ „ Coraki Municipality	998	16	4
33.	Irrigation, Murrumbidgee N.—Bridge at River-street ...	466	15	0
34.	„ „ Bridge at Clark's & Sugden's	764	10	10
35.	„ „ Bridge at Cadell-street ...	443	2	4
36.	„ „ Bridge and Regulator at Common Gate ...	5,112	0	0
37.	„ „ Bridge at Woolshed ...	4,614	13	3
38.	„ „ Syphon at Narrandera ...	1,185	0	0
39.	Lake Cudgellico—Raising Dams A and C...	1,533	0	0
40.	Compensation Weir, Nepean River at Cobbity	1,200	0	0
41.	„ „ „ „ „ Camden	1,200	0	0
42.	Bore at Tyreel	2,466	8	5
43.	„ „ Boronga	4,795	12	8
44.	„ „ Baroma	2,856	15	0
45.	„ „ Boobora	4,288	3	7
46.	„ „ Coollearlee	2,938	7	5
47.	„ „ Merrigal	2,129	0	8
48.	„ „ Pilliga Scrub—3 Shallow Bores	466	10	0
49.	„ „ „ „ Pumping Appliances	690	0	0
50.	„ „ „ „ Shallow Bore, Pumping Appliances	143	8	0
51.	„ „ „ „ Shallow Bore, Tank Stand and Tank	49	10	0
52.	„ „ Drildool	2,110	0	0
53.	„ „ Currumbah	3,648	0	0
54.	„ „ Burren	2,103	0	0
55.	Bore Drains, &c, Tycannah	613	14	6
56.	„ „ Tellerega...	912	0	0
57.	„ „ Holywood	598	0	0
58.	„ „ Bomuckledi	539	0	0
59.	„ „ Ulumbie	182	5	0
60.	„ „ Sherwood	731	10	6
61.	„ „ Gil Gil	115	0	0
62.	„ „ Talmoi	875	0	0
63.	„ „ Weetaliba	777	0	0
64.	„ „ Millie	447	0	0
	Total	£156,529	2	9

List No. 3.

List No. 3.

RAILWAY AND TRAMWAY CONSTRUCTION BRANCH.

		£	s.	d.
1.	Necropolis Extension—Construction of line	3,789	13	10
2.	,, ,, Mortuary Station No. 3 buildings	623	0	0
3.	Manilla to Barraba—Station buildings and trucking-yards	5,167	0	0
4.	,, ,, Water Supply, Barraba	280	0	0
5.	Temora to Barellan (Ariah Park to Barellan)—Station buildings and trucking-yards	6,998	0	0
6.	,, ,, (Ariah Park to Barellan)—Water Supplies, Barellan and Beckom ...	450	0	0
7.	,, ,, (Ariah Park to Barellan)—Sheep and Cattle yards	566	13	0
8.	Belmore to Chapel Road—Construction of Line ...	36,559	4	6
9.	,, ,, ,, Spikes for 80 lb. rails (33 tons)	519	15	0
10.	North Coast, first section—Manufacture of Bridges for Hunter and Paterson Rivers	15,050	0	0
11.	,, ,, ,, ,, Construction of Line	298,235	15	0
12.	,, ,, ,, ,, Switches & Crosses for 80 lb. rails	1,996	0	0
13.	,, ,, ,, ,, Manufacture of Steel Bridges ...	2,249	0	0
14.	Mudgee to Dunedoo (Section, Mudgee to Gulgong)—Construction of Line	41,704	15	4
15.	,, ,, (Section, Mudgee to Gulgong)—Station Buildings	3,759	0	0
16.	Narrabri to Walgett and Collarendabri (Section, Cryon-Walgett)—Tank Stand and Machinery	350	0	0
17.	,, ,, and Collarendabri (Section, Cryon to Walgett)—Station Buildings ...	4,760	0	0
18.	,, ,, and Collarendabri (Station, Cryon to Walgett)—Excavated Tank ...	2,041	14	6
19.	Bogan Gate to Bulbodney (Section, Trundle to Tullamore)—Station Buildings	5,474	5	0
20.	Addison Road Tramway—Construction of Permanent Way	12,389	12	6
21.	,, ,, ,, Overhead Wiring	969	10	0
22.	,, ,, ,, Turnout	98	0	0
23.	Watson's Bay Tramway—Construction of Permanent Way	3,752	2	0
24.	,, ,, ,, Overhead Wiring	933	10	0
25.	,, ,, ,, Waiting-shed	69	17	6
26.	Erskineville Tramway—Construction of Permanent Way	15,208	8	8
27.	,, ,, Overhead Wiring ...	936	9	5
28.	,, ,, Construction of new street, George-street to Regent-street	6,787	17	0
29.	,, ,, Manufacture of Switches and Crossings	459	18	0
30.	Maitland Tramway (steam), alterations to Long Bridge at West Maitland	2,287	7	0
31.	,, ,, (steam), Engine and Car Shed ...	1,650	0	0
32.	,, ,, ,, Terminal Loop and Sidings...	1,516	14	10
33.	,, ,, ,, Crossings, Switches, and Throw-over Levers	235	0	0
34.	Addison Road Tramway and Erskineville Tramway—Three cross-over roads	687	0	0
35.	Willoughby to Chatswood Tramway—Construction of Line	4,166	10	0
36.	Arncliffe to Bexley Tramway (steam)—Construction of Permanent Way	8,803	1	6
37.	Junction-street to Miller-street; Miller-street to McMahon's Point, and Miller-street to Crow's Nest, electric tramway—Construction of Permanent Way ...	17,656	9	8
38.	Gore Hill to Burns Bay Road—Construction of Permanent Way	5,915	2	11
39.	Falcon-street to Suspension Bridge Tramway—Construction of Permanent Way	4,405	19	6
40.	Pumping Machinery	2,544	0	0
41.	Weighing Machines	402	0	0
42.	Dog Spikes for 60 lb. rails (300 tons)	4,725	0	0
43.	,, ,, ,, 80 lb. ,, (100 tons)	1,387	10	0
44.	Trolley Wire	1,888	11	8
45.	60 lb. Rails	45,688	15	6
46.	Fish Plates and Fish Bolts for 60 lb. and 80 lb. rails ...	7,797	10	0
47.	Grooved Steel Rails	9,387	0	0
48.	Switches, 60 lb. Rails	987	10	0
49.	C.I Pipes and Castings, Valves, Hydrants, &c., for Water Supplies	525	15	6
50.	80 lb. Rails (silicon)	56,703	3	4
	Total	£651,539	2	8

H. H. DARE,
Assistant Engineer.

Survey Branch.

Annual Report for the year ending 30th June, 1908.

Owing to the many engineering works in contemplation or in course of construction, and the acquisition of lands in connection therewith, the staff of surveyors have been very fully employed during the past year. There still exists a scarcity of suitable qualified surveyors, and this has to a certain extent retarded the carrying out of engineering surveys on works which have had to be postponed, some, for a considerable time.

Several surveyors have been appointed at different times during the year to the Temporary Staff, who have helped to supply the necessary information for designing schemes appertaining to the various branches of the Department.

The services of a number of private surveyors, both in the city and country, have been availed of, more particularly in connection with the acquisition of lands, in order that the staff surveyors can devote their attention to surveys required for engineering proposals.

Amongst the numerous surveys carried out during the past year for all branches of the Department, the following might be mentioned as giving some idea of the extent and variety of its requirements :—

1. Three surveyors have been almost constantly employed in connection with bore sites and drains for Trust District proposals. As far as the Moree district is concerned, nearly the whole available area suitable for bore drains has been designed into districts, and the survey of bore sites and drains to water same have been completed. Next year it is proposed to deal with a number of Bore Trusts in the Coonamble district.

2. The contouring of the proposed reservoir for the Wyangala Dam on the Lachlan River has been completed, and the necessary steps are being taken to ascertain the advisability of impounding a storage in this locality. Extensive surveys and levels have just been completed in connection with a scheme known as the Macquarie River Improvements, which show that a dam could be constructed on that river, the water from which would command a very extensive area of irrigable lands.

The necessary resumption surveys for the Goondah to Barren Jack railway, over 20 miles in length, has been completed and the area Gazetted.

Resumption surveys have also been completed in connection with the construction of the North Murrumbidgee Canal from the weir site across the Murrumbidgee River at Berembed to the Yanko Siding on the Narrandera to Hay railway line.

Three survey parties are at present carrying out resumption surveys of lands to be acquired, in consequence of the said land being submerged when the Barren Jack Reservoir is full. The details of all improvements on these lands is being surveyed, and particulars noted, so that at the end of December the Land Valuer will be able to deal with the compensation to be paid to the respective owners in a thorough manner.

A surveyor is at present engaged making surveys, taking levels, and acquiring information on the Ana branch of the Darling River, with a view of creating Trust Districts for the proper distribution of water throughout its course.

The flooding of lands adjacent to the Curl Curl Lagoon, near Manly, has been a great loss to the owners of property. A Trust has been formed for the purpose of minimising the trouble and preventing the salt water entering the Lagoon, surveys and levels have been made with the view of constructing a channel (partly in cover) under the face of the cliffs on the northern side, with flood gates to regulate the height of water in the Lagoon.

3. Two Surveyors have been engaged in taking levels for the purpose of draining some of the extensive swamps along the North Coast, more particularly those on the Macleay and Nambucca Rivers and the Byron Bay District. These surveys will be extended over the principal swamps on all the Northern Rivers.

4. Surveyors have also been engaged obtaining the required information for designing sewerage schemes for many of the large country towns.

5. The water supply for country towns has engaged the services of surveyors, but owing to the scarcity of surveyors experienced in this class of work, it has been found impossible to deal with as many localities as could be wished. A scheme for the supply of water to the town of Canbelego and district is nearly completed as far as surveys and levels are concerned, also for the town of Junee ; in the latter case, owing to the undulating country, some difficulty has been found in locating a pipe line at a minimum cost for construction.

6. Several surveyors have been engaged on the Coastal Rivers, exploring and taking levels to ascertain whether there are any suitable sites for the storage of water for generating electricity and for irrigation purposes. On the Warragamba River an excellent dam site is available ; on the Colo River there is one, but the capacity has not yet been ascertained. The Nepean and Shcalhaven Rivers are at present being explored.

7. Hydrographic surveys have been continued throughout the year. The survey and soundings of the Manning River, Camden Haven, and Clarence River entrances have been made, also observations in connection with the coastal currents from north to south of the coast line of the State have been commenced, and will be continued. This work, which will take years to complete, is urgently required in connection with the navigation of the coast.

8. Gauging the principal rivers of the State has been continuously carried out whenever the state of the rivers afforded the required conditions. A staff of surveyors and draughtsmen have been fully employed in field and office compiling complete records of the flows on the respective rivers for which discharges have been obtained.

9. A number of resumption surveys for bridge approaches have been made and reports furnished on several matters connected with preliminary work in connection with proposed national works thoughout the State.

10. Surveys required for Fire Station, Police and Post Office Sites have been very numerous, not only in the suburbs of Sydney, but in country districts, and have been carried out for the most part by private surveyors under instructions from this Department.

Besides the several surveys above mentioned, the whole of the miscellaneous surveys required in connection with the several branches of the Department, such as resumptions, easements, land transfers and certificates required by the Crown Solicitor have been carried out in a satisfactory manner and at a reasonable cost.

A. L. LLOYD,
Chief Surveyor,
Department of Public Works.

The Under Secretary for Public Works.
27th July, 1908.

Survey Drafting Branch.

Report for the year ended 30th June, 1908.

THE Staff in this Branch now consists of 37 draftsmen, 3 searchers, 3 cadets, and 1 clerk; of the draftsmen, 17 are on the permanent list, and 20 on the temporary, and 1 of the searchers also is on the temporary list. Five contract draftsmen are also kept fully employed.

Working plans and sections have been completed during the year for the West Maitland to Dungog section of the North Coast railway, and for the Mudgee to Gulgong railway, and plans and sections for further sections of the North Coast and other railways are well forward.

Trial survey plans and sections have also been completed of the Tenterfield to Casino and Coramba to Dorrigo railways, and earthwork estimates are in hand; trial plans and sections are well advanced for some other proposals.

Trial plans and sections have been prepared for the following tramways:—Ashfield to Dulwich Hill; Military-road to Cremorne; Military-road to Balmoral Beach; Kogarah to Cronulla Beach; Sans Souci to Cronulla Beach; Sutherland to Cronulla Beach; Waverley to Bronte; Windsor to Sackville Reach; Adamstown to the Racecourse; Spit to Manly.

Permanent working plans and sections for the following tramways are complete:—Lillie Bridge to Piper-street—Part 2; Arncliffe to Bexley; Crown-street, *via* Baptist-street, to Phillip-street; Gore Hill to Burns Bay Road; Miller-street to McMahon's Point; Miller-street to Crow's Nest; Falcon-street to Suspension Bridge, Henderson-road extension, *via* Railway Parade; Lighthouse to Clovelly Park, Watson's Bay; Castlereagh-street, *via* Cleveland-street, to Newtown-road; Queen-street to Waverley Depôt; Junction-street, *via* Walker-street and Mount-street, to Miller-street; Regent-street to Erskineville; Willoughby to Chatswood; High-street to West Maitland; Oxide-street, *via* Argent-street, to end of Bland-street, Broken Hill; Beryl-street to Western Oval, Broken Hill.

Plans have been drawn and descriptions prepared for the following Trust proposals, which have been notified and constituted. Bores:—Bald Hill, Baroma, Bcobora, Boronga, Bugilbone, Bunyah, Burren, Coolleearlee, Currumbah, Drildool, Gil Gil, Merrigal, Millie, Nowley, Oreel No. 1 Ext., Oreel No. 2 Ext., Tyreel, Ulumbie Ext., Weetaliba.

Water Conservation.—Algudgerie Creek Weir, Bullatale Creek, Nineteen-mile Dam, Torriganny, Muggabah, and Merrimajeel Creeks, Tuppal Creek.

Drainage.—Coorcobongatti Swamp, Curl Curl Lagoon, Frogmore Swamp, Newrybar Swamp, North Casino Swamp, Ulmarra Swamp.

It may be remarked that in the preparation of each proposal it is necessary to provide—(1) a general plan of the "district" to be embraced, showing tenure of land and position of proposed works; (2) working plans and sections; (3) description of works and district; and (4) Schedule giving particulars of all lands within the district. When the trust has been constituted and the works nearing completion, a roll of all persons entitled to vote for the election of the first trustees is furnished.

Some 29 public watering places have been proclaimed, and 18 of these have been handed over to the various shires, the balance being within the Western Division, and control retained by the Department.

Contour plans have been prepared in connection with several country towns water supply proposals, with tables showing capacity of storage, generally for every foot in depth of water, and finished plans and sections, &c., have also been supplied for several sewerage schemes with the necessary wall maps.

The specially prepared books (2) for complete records of all bores in the State are brought up to date so far as information available will permit; in these books the strata passed through in each case is clearly shown, with depth of bore, particulars as to casing, pressure, flow, analysis of water, locality sketch, &c. There are now 257 private, 139 Government, and 54 improvement lease bores.

In the twelve months 109 applications under the provisions of the "Water Rights Act" have been received, and 63 licenses issued, a few applications have been disallowed, and the balance are in the hands of the various Local Land Boards for inquiry. Thirty-six renewals have been granted by the Minister.

Lithographs of parish and county maps for use of engineers and surveyors, and for illustrating cases, obtained to the number of 864 from the Department of Lands.

Heliographs of plans, sections, &c., numbering 2,719 supplied to the branch by the heliographer, for various purposes, and he has also furnished many mounts and compilations.

It may be remarked here that of the heliographs a fair number are of Sydney and suburbs detail sheets for use in other Departments and also for the public.

Over 160 resumption, easement, and appropriation plans have been drawn; nearly 1,150 searches, as to land matters, made, and well over 4,000 papers or cases dealt with.

The miscellaneous work—investigations in connection with projects, cases, &c., and supplying engineers and surveyors with information for field use has been very heavy.

J. MARSHALL,
Chief Survey Draftsman,
Public Works Department.

The Under Secretary for Public Works.

Report of Superintendent of Plant and Stores for the Year ending 30th June, 1908.

Plant and Stores, Cement Testing, and Timber Inspection.

Sir,

I have the honor to submit report covering the operations of this Branch for the year ending 30th June, 1908.

The work generally shows an increase on that of the previous year.

The value of the supplies as represented by the requisitions is less than that of 1906-7 by £24,632 13s. 3d., the largest drop being under the heading of Railway Construction.

It will be observed that although the Roads and Bridges Branch was abolished on 1st January, 1907, the number of requisitions received and the value of the material supplied for National Works are in excess of those of the previous year.

The number of requisitions received for all services exceed those of last year by 2,376, and the number of orders by 2,031.

The average value of the requisitions dealt with is £15 15s. 0d., and that of orders £13 14s. 2d.

Table "A" is a summary of the operations in connection with requisitions submitted by and orders issued for each Branch during the year, and Table "B" is a comparative statement showing in detail the expenditure during the years 1900-1, 1906-7, and the year just completed. As mentioned in my last report 1900-1, is made the standard for comparison by reason of the day-labour system of carrying out works being practically at its zenith during that year.

"A."

SUMMARY.—Material and Services requisitioned for during period 1st July, 1907, to 30th June, 1908.

Branch.	Requisitions.	
	Number.	Estimated Value.
		£ s. d.
Government Architect's	3,829	27,110 19 0
Rivers, Water Supply, and Drainage	5,867	109,461 17 0
Railway Construction	934	86,634 6 10
National Works—Roads and Bridges	3,133	19,527 5 10
Labour Commissioners	980	4,442 15 10
Head Office and General	1,113	2,528 6 2
Totals	15,856	249,705 10 8
To Stores Supply and Tender Board—		
Maintenance, Dredges and Ferries	124	546 3 11
Other Services	622	3,732 14 1
Grand Totals	16,602	£253,984 8 8

Number of orders issued 18,219

"B."

COMPARATIVE Statement showing the estimated value of Material and Services requisitioned for by Public Works Officers during the years 1900–1, 1906–7, and 1907–8.

Work or Service.	Number of Requisitions issued.			Estimated value of Materials requisitioned for.		
	1900-1.	1906-7.	1907-8.	1900-1.	1906-7.	1907-8.
				£	£	£
Government Architect's	5,525	3,313	3,829	102,284 15 4	27,543 0 3	27,110 19 0
Darling Harbour Resumptions	.....	.....	.....	13,256 9 3	.....	.....
Harbours and Rivers	2,506	760	1,090	44,182 17 2	16,327 6 10	21,6 9 10 1
Government Dockyard	287	.....	.....	24,165 19 8	....	....
Dredge Service	1,526	1,902	2,008	29,266 1 8	13,808 8 4	20,520 4 3
Sydney and Suburbs Water Supply and Sewerage	.....	47	109	....	210 18 0	2,237 12 4
Country Towns Water Supply	2,486	639	680	93,717 19 5	42,007 8 11	28,516 19 5
Darren Jack	... ..	291	1,140	.....	6,596 5 8	29,553 0 0
Miscellaneous Water Supply and Sewerage	... ..	669	520	....	33,645 13 2	2,351 9 1
Railway Construction	1,258	696	527	21,040 11 4	114,153 11 8	42,996 13 8
Tramway Construction	641	.....	407	30,713 7 5	.....	43,637 13 2
National Works, Roads	3,814	2,770	2,932	26,181 16 3	12,215 18 0	15,883 0 9
National Works, Bridges (not included in Roads)	615	112	201	7,397 9 2	549 6 5	3,644 5 0
Public Watering Places	607	367	320	8,514 5 11	2,322 0 6	4,673 1 11
Labour Commissioners	.....	819	980	.....	3,376 17 7	4,442 15 10
Head Office	377	790	720	2,161 16 4	682 15 8	666 6 9
General	232	305	393	1,113 9 1	1,656 18 5	1,861 19 5
Totals	19,874	13,480	15,856	403,996 19 0	275,096 9 5	249,705 10 8
Numbers of Orders issued	43,500	16,188	18,219	.....	.....	....

Supplies.

Supplies.

There have been very few complaints in regard to delay in supply. The quality of the material has been generally of a good standard, although there have been one or two cases where stores have been rejected. On the inferiority of the supply being pointed out, the contractors have at once made good.

Although 98 cancellation notices were issued, it was only in 14 cases that suppliers were penalised by having the articles purchased at their risk ; it may, therefore, be concluded that altogether the services have been satisfactorily performed.

Articles to the number of 1,334 not included in contract schedule were ordered during the year. During the previous year the out-of-contract purchases only totalled 533. It will, therefore, be seen that the volume and the variety of work have much increased. Notwithstanding the comprehensive nature of the annual contracts, there are still many requirements for this Department that could not well be included without making the volume unnecessarily cumbersome. Comprised in these orders are many articles for special purposes which are only obtainable from one firm, or have a standard rate fixed. Little benefit would, therefore, be gained by loading the schedule with such articles.

Quotations.

Quotations, as per regulations, were invited for 231 services, 1,217 forms were prepared and posted, giving an average of over 5 requests for each requirement, whilst altogether 720 quotations were received, showing that there was competition in practically every case.

The total value of the articles, for which quotations were accepted, was £10,086 3s. 1d., giving an average value of £43 13s. 3d.

In cases where the value of the material required was below £5, and was not included in any of the annual contracts, prices were arranged. Articles numbering 949, valued at £1,214 4s. 6d., were purchased in this way.

Crane and Cable Chain for 169 different services was inspected, weighed, forwarded, and certificates of Admiralty tests obtained—the total length of chain supplied being 3,555 fathoms.

Customs Entries.

The Customs work shows a marked increase, the value of the imports on which duty amounting to £12,934 3s. 4d. was paid under protest, being £103,549 10s. 5d.

Altogether since State imports were made subject to duty, the sum of £63,198 5s. 1d. has been paid by the Department.

Stationery, Draftsmen's Material, &c.

Although the number of sources to which supplies have to be made are reduced on account of the abolition of the Roads and Bridges Branch, still, because of increase of work in Head Office and the consequent employment of more hands, the issues have been greater than during 1906–7, the number of requisitions dealt with being 5,348 as against 4,908 during the previous year. The freight, postage, and cartage on parcels amounted to £174 10s. 11d., as against £190 7s. 7d. during 1906–7.

	£	s.	d.
Value of stationery and draftsmen's material in stock on 1st July, 1907	387	8	10
Value received for stock	1,438	6	7
„ issued from stock...	1,489	7	9
Balance on hand	336	7	8

Surveying and Engineering Instruments.

The estimated value of surveying and engineering instruments belonging to the Department on 30th June of this year was £3,024 15s. (Head Office, £740 ; Field, £2,284 15s.).

Stamps—Postage and Railway.

	£	s.	d.
Postage stamps distributed during year	2,854	5	9
„ used „	2,845	16	11
Railway stamps distributed „	298	19	0
„ used „	288	19	3
Average disbursement per annum	3,828	9	8

There has been a falling off all round, practically entirely due to the reduction on the number of country officers.

Telephone Services.

The amount paid in connection with telephone services for the year is £538 16s. 11d., representing thirty connections. The Toll System does not yet operate so far as this Department is concerned.

Library Operations.

During the year an inventory of the books in the Library has been prepared, and many which have been on loan for considerable periods are gradually being recalled. The method of indexing books has been altered, so that instead of merely the titles being given, the names of the authors and the subjects treated of therein are shown. This matter is recorded on cards, and thus the maintenance of the alphabetical sequence is made possible. Only the accessions during the period since the change of control have so far been indexed in this way. Cataloguing books in this manner will greatly assist borrowers in making selections, and more especially will this advantage be noticed as the collection extends.

During the year 63 Books were added, 64 Volumes of Engineering periodicals were prepared for binding, 307 Books were issued, and 727 Engineering and Architectural periodicals were received and distributed.

Property

Property on Works.

The returns submitted are on similar lines to those received last year. These include buildings, fixed plant, service railways, breakwater tramlines, stores, dredges, tugs, punts, boats, machinery and tools.

Valuations have been made of each separate item, and the statement which is subjoined shows the value of all property under the different sections of the Department.

Section.	Buildings.	Plant and material.	Boats, punts, tugs and launches, pipes, pontoons.	Dredges.	Docks.	Wharves.	Artesian casing in country.	Fencing at tanks.	Total.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
ter Supply and Sewerage	6,033 4 1	110,542 2 8	17 0 0	.....	.....	.....	....	....	116,592 6 9
olic Watering Places	4,479 9 6	14,177 18 6	19 0 0	.....	.....	....	....	5,301 0 0	23,977 8 0
esian Plant	.....	.....	.....	.....	.....	....	2,083 8 1	....	2,083 8 1
rbours and Rivers	7,000 2 11	90,624 4 0	14,198 13 0	.....	13,900 0 0	627 10 0	....	....	126,350 9 11
dge Service	.....	.....	102,975 0 0	257,050 0 0	.....	....	....	....	360,025 0 0
ional Works	2,835 15 0	5,385 8 2	12,526 0 0	.....	.....	....	....	....	20,747 3 2
lways and Tramways	973 0 0	7,682 16 2	.....	.....	.....	....	....	....	8,655 16 2
vernment Architect	78 0 0	4,515 1 5	.....	.....	.....	....	....	....	4,593 1 5
cellaneous	4,874 12 1	2,777 16 4	.....	.....	.....	....	....	....	7,652 8 5
tionery and Instruments	.....	3,361 2 8	.....	.....	.....	....	....	....	3,361 2 8
olic Works Stock	.....	164,225 1 0	.....	.....	.....	....	....	....	164,225 1 0
Totals	26,274 3 7	403,291 10 11	129,735 13 0	257,050 0 0	13,900 0 0	627 10 0	2,083 8 1	5,301 0 0	838,263 5 7

A comparison with the returns submitted last year discloses that, with the exception of wharves and artesian casing, there has been a considerable increase. The total of the assets amounts to £838,263 5s. 7d., as against £730,320 15s. last year.

Pyrmont Depôt.

The depôt at Murray-street, Pyrmont, continues to be a very useful establishment, and although "Day Labour" work has decreased, other contracts have very largely benefited from this branch of the Department.

As in previous years, there has been a considerable turnover of plant, tools, and material, and every effort is made to give the quickest despatch of plant selected from Depôt Stock, or that which is frequently assembled for various works. The location of the depôt lends materially to the quickness of despatch by road, rail, or sea.

The Metropolitan District Works have not drawn so extensively from stock as in former years. This is probably accounted for by the disappearance practically of the Unemployed Relief Works, occasioned by the increased prosperity of the State, which in former years at certain seasons were responsible for heavy demands being made for tools.

Officers from various branches, particularly that of Water Conservation, have taken advantage of the Depôt Stock and utilized where possible such machinery, tools, or plant, that were found to be available and suitable. A number of equipments for the construction and repairs of several bridges have been supplied, and it is in connection with supplies to such large works that the Department effects considerable saving through having at the depôt suitable plant and tools.

Diamond Drills and hand-boring Plants have been very much in demand throughout the year, the former for testing for coal and gold and the latter for Country Towns Water Supplies, Sewerage, Water Conservation, Railway Works, Prospecting, &c.

There have also been numerous calls for Survey Camp Equipment.

The depôt has been availed of, perhaps, more than ever in the assembling of plant, tools and material for various works. This allows of an opportunity for inspection previous to despatch, and an economy in freight through forwarding the whole of the requirements in one consignment.

The Timber Yard which has been located for some years at Cockatoo has been closed, and the whole of the Water Conservation material stored there has been removed to the depôt—this consists of troughing, buckle plate tanks, artesian bore casing, and wire ropes for ferries.

Tools, &c., have also been returned from seventy-seven works, and issues made to practically as many.

An addition to the work of the Depôt is the distribution of all iron forwarded from Messrs. G. & C. Hoskins, Limited, at Lithgow, for the Public Works Department (including Government Dock), Sydney Harbour Trust, Metropolitan Board of Water Supply and Sewerage, and Stores Supply and Tender Board. All consignments to Sydney are sent to the Storekeeper who supervises the delivery. On receipt of advices cartage is arranged, and the different Departments notified and asked for acknowledgment of receipt, whereupon the storekeeper is in a position to certify to cartage vouchers, and inquire if there is any undue delay in transit. This entails a good deal of extra work, but so far this system has been working satisfactorily.

The expenditure during the year on account of salaries, wages and other expenses amounted to £1,223 2s. 6d.

Of the wages paid only £434 15s. 10d. is directly chargeable to the maintenance of Depôt, the remainder being on account of repairs and renovations.

The total number of vouchers dealt with during the year was 1,303, representing in value £26,488 18s. 4d.

Cement Testing, Pipe Inspection, &c.

The tests and inspections made during the year are in excess of those carried out during 1906–7 the earthenware pipe inspection being especially heavy.

The number of tests were:—Cement 120, Sand 12, Experimental Chemical 92, and Mechanical 207, making a total of 431.

The quantity of cement tested totalled 300,000 bags of locally manufactured, and 753 casks of imported.

The

The cement issued on account of private orders was 117,267 bags.

Departmental orders 103,599 bags, and to the Railway Commissioners 79,134 bags.

The total No. of 4 in. to 24 in. Earthenware Pipes, including junctions, bends, traps and discs inspected was 39,584.

The fees received for cement tests and seals on bags amounted to £583 19s. 1d., while the expenditure on account of salaries and wages, office rent, travelling, and other expenses, totalled £825 12s. 6d.

The fact that every pipe required for the Parramatta Sewerage work must successfully pass an hydraulic test equal to a pressure of 13 lb. per square inch, explains to a considerable degree the reason of the heavy work in regard to this inspection. The testing too, is much greater than the returns show, as at times only about 10 per cent. of the pipes submitted withstand the pressure.

Besides the established cement tests, long period tests of concrete, experimental tests of sand, stone, explosives, and bitumen compounds have been made.

The question of the adulteration of cement by the introduction of gypsum during manufacture was also further considered during the year, and it was decided by the Reference Board that the test for sulphuric acid be added to the other chemical standard tests, and a maximum allowance of 2 per cent. was fixed.

Several complaints as to the quality of the cement supplied were made, but on the cement being retested it was found to be sound and up to requirements.

Tests made of imported Cements "Anchor," "Alsen," and "Pyramid" Brands.

The comparison between these cements and those locally manufactured is in favour of the local article, excepting, perhaps, in the case of the "Pyramid" brand, which, it will be observed, is a very finely ground cement. This shows a higher tensile and compressive strength than either of the other brands, equalling practically both the "Union" and "Rock" brands.

The pat tests for soundness are satisfactory; the expansion, as shown by Bauschinger's apparatus, is in each case lower than the average expansion of the local cement. This is probably attributable to the lower percentage of alumina, as shown by the analysis, and also to the greater age of the imported cements, when put under tests. The local cements are tested when fairly fresh, the large demand allowing very little opportunity for aëration before testing. Aëration has the effect of reducing the expansion, as has been proved by the retesting of cements which at the first tests have shown an expansion over the Departmental standard.

The "lamp chimney" test was also made, and the tubes showing the results were submitted for the information of the Reference Board.

In no instance was this test satisfactory. The "Pyramid," however, came nearer to perfection than any of the others, probably accountable to the fineness of the grinding and the high percentage of silica, which allows of the quick hardening of the upper layers, thus preventing further action by the hot water on the lower stratum of the cement. This test is, however, considered to be of very little value, it being recognised that all first-class cements expand to a greater or less degree during the setting process.

There is a feature which might be noticed in regard to recent date finely ground cements, which is prominent in the three imported cements tested. In the neat cement tensile test the strength of the cement at seven days is practically equal to that at twenty-eight days.

Beyond the hot bath test, the neat cement tests are not now considered conclusive, more dependence being put on the sand tensile test and the compressive test. The comparative analysis of the local cements and the imported cements tested is as subjoined :—

	Brand and No. of Test.				
	Anchor, 2,944.	Alsen, 2,947.	Pyramid, 2,948.	Rock, 2,940.	Union, 2,854.
Loss by calcination	2·40	1·10	1·30	1·40	1·38
Insoluble residue	2·60	1·30	0·80	0 45	0·70
Silica, $Si_1 O_2$	19·70	19·20	22·50	20·80	21·07
Alumina and iron, $Al_2 O_3$ $Fe_2 O_3$	10·60	9·70	9·20	11·00	11·16
Lime CaO	60·60	61·50	62·80	63·50	63·02
Magnesia, MgO	0·94	1·84	1·11	1·45	0·39
Sulphuric acid, SO_3	1·78	2·43	2·30	1·40	1·78
Alkalies	1·38	2·93	.....	.....	·50
	100 00	100·00	100·00	100 00	100·00

Tests of "Virite" and other Explosives.

In order that a comparison might be made as to the effective values of the proprietary explosives, as used by the Department, and the explosive "Virite," it was arranged that tests under similar conditions should be carried out.

The several tests were made in the presence of the Under Secretary for Public Works, several Naval and Military officers, Dr. Le Brun, officers of the Works Department, and representatives of the different explosive companies.

The compositions put under test were :—1. "Lithyte"—Australian Lithyte Explosive Co. 2. "Rackarock"—N. Guthridge (Limited). 3. "Rackarock"—Nobel's—Dalgety & Co. (Limited). 4. "Virite"—Dr. Le Brun.

On the first day the lead cubes used were 12 in. x 9 in. x 6 in. In each of these were drilled three holes 1 inch diameter, 3 inches apart centre to centre, and 6 inches deep.

The results were as follow :—

1. "Lithyte," the holes were charged with 3 in. x 1 in. plugs, 360 grains, in which were inserted No. 6 detonators attached to lengths of Bickford's fuse. Plaster of Paris was used for tamping, and when this had set the holes were fired simultaneously. The measurement of the holes before firing totalled 231 cubic centimetres, and after firing the expansion was such that the capacity was increased to 2,900 c.c.

2. Guthridge's "Rackarock," under similar conditions, with 3 in. x 1 in. plugs, weighing 670 grains, the capacity was increased to 3,680 c.c.
3. Dalgety's "Rackarock," the same sized plug, weighed 620 grains, the capacity after firing being 3,580 c.c.
4. "Virite." This explosive, which is of a granular nature, and not compressed, was next tried. It is fired with a fuse without the assistance of detonators. Of this composition 640 grains were weighed out, but being of greater bulk than those already tried, it was found impossible to get this quantity in the hole without seriously reducing the depth of tamping. However, a quantity which allowed for practically 3 inches pipe-clay tamping was inserted in each hole, and thoroughly rammed with an iron rammer. The fuse was then lighted, but blew out in each case, the explosive having no effect on the lead.

As the manufacturer considered that the conditions were not favorable, it was arranged that a further set of experiments should take place, he being allowed the privilege of fixing the sizes of the blocks, depth of hole, &c.

The decision was that for "Virite," a block 18 in. x 6 in. x 6 in., with a hole 15 in. deep, 1½ in. diameter was to be used, and for the other explosives, blocks measuring 15 in. x 6 in. x 6 in., with one hole in each block, 12 in. deep and 1½ in. diameter.

The results showed as follows :—

1. "Lithyte"—Plug 1,460 grains, 3 in. x 1½ in., tamped with plaster of Paris, fired with fuse and No. 6 detonator. Split the block on all sides, the expansion being considerable.
2. Guthridge's "Rackarock"—Plug same size and weight. This also split the block on the four sides, but the effect was not so satisfactory as with the "Lithyte."
3. Dalgety's "Rackarock"—Plug same size and weight. This shattered the block on all four sides, and blew out the bottom as well. Very satisfactory.
4. "Virite"—1,460 grains were weighed out and tightly rammed into the hole, the tamping used being fire clay. To prevent the tamping blowing out as on the previous occasion, the block was turned over on to an iron plate, with the tamping down. The fuse was then lighted, but the result was very disappointing ; all that happened was the blowing out of the 3 in. of lead below the explosive, but there was no expansion of the block observable.

Every assistance was given those connected with this composition, but the results obtained were very unsatisfactory.

The tests made with the other explosives go to show that they are all very effective. It would not be well to claim from these experiments that one was superior to another, as further trials might just reverse the results obtained.

For practical purposes therefore they may be taken to be equal.

Bitumenous Compound.

Tests were made in order to ascertain the tensile strength of a bitumenous compound which was being introduced as jointing for earthenware pipes in connection with Parramatta sewerage.

The composition consisted of 2 lb. of bitumen, ½ lb. of pitch, and 1⅓ lb. blue-metal dust.

Bitumen	2·0 lb.
Pitch	0·5 „
Blue-metal dust	1·38 „

The briquettes made had an area of 5 sq. c.m., and were kept at 64° Fah. The results obtained from three briquettes were :—490, 400, and 530 lb. per sq. in., giving an average of 473 lb. per sq. in.

The specific gravities of the materials used were :—Bitumen, 1·42, pitch 1·14, and blue metal dust 2·95.

Tests as to the porosity of earthenware pipes were made, with the following results :—Earthenware pipes from Wagga, 8·08 per cent , Dean & Sons pipes, 3·11 per cent. (average).

Stock-taking.

The results of Stock-taking at the various Stores have proved fairly satisfactory, and the stores and material were found to be well kept.

Public Works Store Advance Account.

From the statement following it will be seen that the stock under this account on the 30th June, 1908, amounted to £164,225 1s., an increase of £3,601 0s. 7d. as compared with last year.

The Roads and Bridges stock and the Water Supply and Sewerage stock have been merged into the General Depôt and the Government Dockyard stocks. This arrangement has proved an economy, and the stocks are well handled.

PUBLIC WORKS STORE ADVANCE ACCOUNT, £257,000.

Statement showing operations for year ending 30th June, 1908.

Stock.	Amount allotted from General Vote.	Value of Stock 30th June, 1907.	Purchases and Returns.	Issues.	Stock Transfers. Debits.	Stock Transfers. Credits.	Value of Stock 30th June, 1908.
	£ s. d	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
ilway and Tramway construction ...	220,000 0 0	131,507 8 0	113,892 8 1	110,329 4 1	224 9 10	1,887 17 2	133,407 4 8
neral Depôt, Pyrmont	16,000 0 0	14,185 7 11	5,935 3 0	8,111 2 9	3,387 15 3	301 2 0	15,096 0 11
vernment Dockyard	7,000 0 0	5,286 1 0	16,629 2 2	14,205 2 0	451 15 11	334 11 8	7,827 5 5
vernment Architect's Yard	7,000 0 0	4,416 5 0	7,344 8 0	6,623 4 1	155 5 8	46 3 3	5,246 11 4
ater Supply and Sewerage.....	3,000 0 0	2,307 15 2	8 1 7	954 2 5	2 7 8	1,364 2 0	....
ads and Bridges	1,000 0 0	870 6 1	2 1 6	378 9 7	.....	493 18 0	.....
wcastle.....	3,000 0 0	2,050 17 3	6,117 5 8	5,726 4 6	206 0 3	.....	2,647 18 8
Totals	257,000 0 0	160,624 0 5	149,928 10 0	146,327 9 5	4,427 14 7	4,427 14 7	164,225 1 0

Increase in total value of stock, £3,601 0s. 7d.

Timber Inspection.

Four inspectors have been fully employed in the classification of timber for departmental purposes. Details of work done and timber passed are as under:—

Number of inspections made...	2,815
Sleepers passed and branded...	145,198
Piles (lineal feet)	15,941
Sawn and hewn timber (super. feet)	1,750,908

Inspection of Plant, &c.

An inspection of the plant on the Northern Rivers Harbour Works was made during the year, and recommendations submitted as to maintenance and transfer. Plant was also selected for the Lands Department for use in connection with the Pilliga scrub-clearing contract.

Another feature of the year's operations was the disposal of the Cataract Dam plant which was on hand on completion of that work. The bulk of this material has been transferred to Barren Jack Dam, Goondah to Barren Jack Railway, Berembed Weir, Depôt stock, and other works, while the surplus tools, &c., of no further use to the Department, were disposed of locally. The value of the plant so transferred was £16,553 8s. 2d.

J. M. CAMERON,
Superintendent of Plant and Stores.

Commercial Testing of Steel and Iron.

By W. F. Burrow, Member of the Iron and Steel Institute, London, Government Testing Engineer, Lithgow, N.S.W.

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COMMERCIAL TESTING OF STEEL AND IRON.

THE great developments in engineering enterprise during the last few years, bringing a steady and increasing demand for steel and iron of the highest class, render it necessary that machine and other tests of the most rigid character should be made at the manufacturer's works. For this reason, modern testing machines usually form a portion of the plant of most rolling mills in Europe and America, and iron and steel supplied to the Government or large engineering works, is usually tested in the presence of qualified inspectors before leaving the mills. This system of testing is usually referred to as "Commercial Testing" which is somewhat different to the work done by engineering and physical laboratories established in various centres for the testing and analysis of all classes of engineering material.

Engineers throughout the world owe a debt of gratitude to such men as David Kirkaldy, who established a large testing works in London, under the most difficult and trying conditions, and carried out there for many years the most painstaking investigations into the strength of materials, the value of which is inestimable.

The Engineering Laboratory of the City and Guilds of London Institute, controlled by Professor Unwin; the Testing Works of Charlottenburg in Germany, controlled by Professor Martens; and here in Australia, the Engineering Laboratory of the Sydney University, under the guidance of Professor Warren, have earned world-wide reputations for original research in the direction of scientific testing; giving to the engineer an accurate and modern knowledge of the constructional value of the materials at his command.

The introduction of new materials has made the work of these physicists of paramount importance, and Australian engineers are indebted especially to Professor Warren for his extensive contributions to the science of testing, and his valuable works on the properties of Australian timbers.

With the introduction of the steel and iron industry into Australia came a new set of conditions as regards testing.

This industry might be said to have commenced on commercial lines in May, 1907, when the first pig-iron from a modern blast furnace was produced at Lithgow.

The erection of this blast furnace followed the letting of a lenghty contract to the Wm. Sandford, Ltd., Coy., for the supply of the principal portion of the iron and steel required for Government use.

It was wisely decided, after considering the new conditions involved in this contract, to establish a Government Testing Works at Lithgow, immediately adjacent to the Rolling Mills of the Wm. Sandford Coy. (Eskbank).

No data was available as to the class of pig-iron to be produced by the first blast furnace, and its influence upon the quality of steel and wrought-iron manufactured from it.

The whole process of manufacture had therefore to be carefully watched from the inception of the industry, and every effort made to establish a standard of quality in all departments, that would bear favourable comparison with the products of the leading iron-producing centres of the world.

A modern testing works with a resident staff of trained inspectors entirely controlled by the Government has therefore been established at Lithgow since the commencement of the contract, and the hundreds of test certificates issued, covering all qualities of steel and iron bars and sections, bear testimony to a gradual improvement in the quality of material produced at the Eskbank Works.

On the establishment of this Testing Office, the matter of machine testing had to be carefully considered, also the special means for supplying the Government Departments and engineers throughout the State with detailed particulars of the quality of material daily submitted for their use.

The Engineering Laboratories referred to have in use very complete systems and standards for testing all kinds of engineering material. Unfortunately, these systems and standards vary considerably; and while the standards of most modern physical laboratories are practically in agreement, the same cannot be said of those used by the rolling mills of England and America in the commercial testing of steel and iron.

Until very recent years, little attention has been given to the important matter of standardising the many systems of testing in vogue.

Professor Warren was early in drawing attention to the importance of establishing a uniform system of tests for construction materials, and contributed a valuable paper to the Royal Society of New South Wales, on 16th June, 1897: *The Unification of the Methods of Testing Materials used in Construction.*

Since that date much has been written upon the subject, and the British Standards Committee has published many valuable reports and recommendations for the unification of the system of testing.

Then there are several well-known standard works on the scientific testing of materials in physical laboratories, which again are not in perfect agreement, and cover a wide range of engineering material.

It was considered of the utmost importance that a modern system should be introduced into the Government Testing Office at Lithgow, having at once the sanction of leading scientific authorities on the testing of materials, and also the confidence of engineers, who would daily receive its "Certificate of Tests."

The forms of test bars, the gauge lengths, and systems of measuring the elongation and recording useful data of ductility, are still, in spite of the efforts made to secure uniformity, very diverse; engineers have still much difficulty in comparing results obtained at different times, from different sources.

We still meet in current journals, and test sheets, particulars of tests giving the elongation on a gauge length of 10, 8, 6, and sometimes 2 inches, with no reference to the ratio of gauge length to diameter. Then it is found that a gauge length of 8 inches is used both for a bar of 1 inch and for one of $\frac{1}{4}$ in. diameter, although it has been constantly demonstrated that the larger bar would give a considerably greater elongation than the smaller, using identical material.

These

These and many other similar points have been clearly defined by metallurgists and physicists; but, as far as the author is aware, there is not in existence a modern treatise dealing entirely with the commercial testing of steel and iron.

To fill this gap has been the object of this present paper, which it is hoped will provide a ready reference to the systems and standards adopted in the Government Testing Office, Lithgow, and enable the test certificates issued to be clearly understood and made always comparable.

It is further hoped that the paper will assist in the ultimate unification of the methods of testing so ably championed by Professor Warren.

This is especially desirable now that the steel and iron industry has been established in Australia.

The paper is strictly confined to the commercial testing of steel and iron, the nature of which is clearly defined.

It contains detailed drawings of all the test bars used in the Testing Office, together with a large number of recorded experiments made with imported and Lithgow steel and iron. The tables of analysis and machine tests of British and Australian steel and iron placed side by side, forms the first of what is hoped will be a number of papers bearing upon this important industry.

In connection with the Government Contract previously referred to, there is one point calling for special attention under the head of Commercial Testing. With thousands of bars passing through the hands of the Inspectors daily, it is not possible, without a very extensive testing works, to prepare an accurate and fully turned standard test bar for every consignment; nor is this necessary. Mr. David Kirkaldy constantly used bars as received directly from the rolls, and tested them without special preparation.

This is done at Lithgow, as will be explained. As, however, small bars when tested in the rough are apt to break in or near the grips, what is termed a "partially turned bar," is used as much as possible when time will not permit of a standard bar being turned, and the material is urgently wanted.

It will be shown that the use of these rough and partially-turned bars can be scientifically accurate if the effect of grips, and the ratio of length to diameter between grips is carefully planned.

As far as the author is aware, there is no publication in use giving standard lengths and forms for rough and partially turned bars.

The drawings giving these particulars, and the tables giving results of testing such bars, together with accurately turned standard bars of identical material, may therefore be found of considerable interest to engineers daily using Lithgow steel and iron.

Commercial Testing of Steel and Iron.

1. *The Testing Works at Eskbank.*—The Government Testing Works at Eskbank contain most of the modern appliances for the testing and proper determination of the qualities of iron and steel.

At present (June, 1908) a 50-ton Olsen testing machine is installed, but this will be shortly replaced by a 100-ton Riehlé machine imported from Philadelphia. A Moore and Dempster lathe and milling machine is also erected in the machine-room, together with cold saws, forge, and the necessary tools for the preparation of test specimens, and the making of forge and other tests specified.

The works are therefore self-contained, and when the samples of iron and steel are constantly brought by the Inspectors, they are put through the varied stages of testing, until finally the "Test Certificate" is signed by the Engineer-in-Charge, and sent to the head of the Government Department ordering the material.

Engineers in charge of Government works are thus daily in receipt of certificates that all the material used by them has been tested and branded in accordance with their various specifications.

2. *Tests applied to Iron and Steel.*—Professor Harbord, in his work on the *Metallurgy of Steel* states:—

"Broadly speaking, the tests applied to iron and steel may be divided into two classes:—(1) Hot tests to insure that the metal is free from all red shortness at all temperatures above a red heat, and is of good welding qualities; and (2) cold tests to insure that the metal possesses the required strength, elasticity, ductility, &c., and is free from cold shortness, or tendency to brittleness when cold."

The province of this paper is to deal with clause No. 2, and the results obtained in ordinary testing machines.

It is well, perhaps, at this stage to quote in detail the definitions by Professor Harbord of certain terms which are used to express these results.

3. *Tensile strength—ultimate or maximum stress.*—Maximum load may be defined as the maximum stress which a bar of the material can sustain without rupture when a pulling force is applied gradually in the direction of its length. It is expressed in tons, pounds, or kilogrammes per unit area of the cross section of the test bar, usually per square inch or square millimetre.

4. *Elastic Limit* is the maximum stress a material can bear without suffering permanent distortions, or "set." This is also usually expressed in pounds or tons per square inch, or kilogrammes per square millimetre.

Within certain limits, steel is an elastic body, and on being elongated by a tensile stress, returns to its original dimensions when the force ceases to be applied.

When the applied force exceeds a certain amount, the material becomes permanently distorted, and "permanent set" takes place. Within the limits of elasticity, under equal variation of loading, a metal bar of uniform section lengthens or shortens equally through its entire length, and on removal of the load returns

returns to its original size, and such loading may be repeated indefinitely, subject to the condition known as fatigue, without deterioration of the material in any way. If, however, the material is once subjected to stresses in excess of its elastic limit, it is permanently altered, and under a series of such stresses it becomes more or less plastic, and finally breaks down.

Professor Unwin distinguished the two deformations referred to as :—

5. *Elastic Deformation.*—That which disappears when the load is removed ; and

6. *Plastic Deformation.*—That permanent distortion which remains after the load is removed.

These definitions probably give as correct an idea of the physical state of the material when subjected to the two stresses as it is possible to convey ; the elastic limit seems to mark the boundary between the elastic and plastic conditions.

7. *In Commercial Testing* the engineer is concerned principally with the plastic deformation of material, and he usually leaves the investigations within the elastic limit to the physicists of engineering laboratories. The value to engineers of these investigations cannot be over estimated ; but it will be readily understood that a Commercial Testing Office, dealing with a large number of specimens daily, and hundreds of tons of material waiting removal by rail, is not the place to conduct the delicate manipulation and measurements required in dealing with the elastic deformation of material. It may be desirable, however, to complete the definitions of terms given by Professor Harbord and refer to the :—

8. *Modulus of Elasticity* (*Young's Modulus*).—As a perfectly elastic body shortens or lengthens equally under equal additions of stress, it is therefore obvious there must be some force which would stretch such a body to twice its length, and this stress expressed in tons, pounds, or kilogrammes per unit section of cross area, is termed the modulus of elasticity. Thus, assuming a steel bar 3 in. long and 1 square inch sectional area is stretched by a force of 13 tons, ·003 of an inch without permanent set, by a simple proportion sum we are able to find the force which will be required to stretch it 3 inches. Thus :—

	Extension.		Inches.		Tons.		Tons.
	·003	:	3	::	13	:	x
$\therefore$	x	=	$\frac{39}{\cdot 003}$	=	13,000 tons per square inch ; and this is known as Young's Modulus.		

9. *Young's Modulus* may be defined as the force which, acting in the direction of the length of a bar, when applied to one end of it, the other end being fixed, would double the length of the bar, the cross section being of the unit area, say 1 square inch. As no metallic substance can thus be doubled in length, the modulus may be defined as 1,000 times the force, which would increase the length by the $\frac{1}{1,000}$ part of the whole, or 1,000,000 times the force which would increase the length by $\frac{1}{1,000,000}$ part of the whole.

In wrought iron and mild steel the value of Young's modulus is about 13,000 tons per square inch—in other words, a stress of 1 ton per square inch produces an extension which is $\frac{1}{13,000}$ of the original length of the bar.

Young's modulus can be calculated by the following formula :—

$$\frac{p \times L}{w \times l} = E.$$

where p = stress.
w = original sectional area.
L = original length of sample.
l = extension measured.

10. *Yield Point.*—This is a very noticeable point in rolled or hammered iron or steel, which occurs just when the elastic limit has been exceeded, and which apparently marks the breaking down of the original molecular arrangement.

At this point, without any increase of stress, the bar suddenly and permanently elongates to a considerable amount, often to 100 times its whole previous elongation, and then again recovers somewhat its original rigidity, and a greater load has to be applied before there is any further elongation, or the bar can be fractured.

In ordinary commercial testing this point is generally taken as the elastic limit, and is very noticeable by the "drop of the beam" of the testing machine ; this is hardly correct, as it is not precisely identical with the elastic limit, although very near it.

In investigating the properties of a material, and its suitability for structural work or other engineering purposes in which it will be subjected to varied stresses, probably nothing is of greater importance than the elastic limit and the yield point ; as however great the ultimate breaking load may be, when once this elastic limit is passed, we are dealing with a plastic material, which, under the action of stress, will continue to go on deforming, and consequently must be an unsafe material to use.

In actual practice, however, this determination is often omitted by steel makers, and is frequently not specified by engineers ; the ultimate breaking load, elongation, and contraction of area being considered sufficient.

11. *Reduction of Area.*—This is the amount of contraction of area which takes place at the point of fracture when a metal bar is broken by a direct pulling force. It is usually expressed in percentages of contraction of area as compared with the original sectional area of the bar. Both the elongation and reduction of area furnish valuable indications of the ductility of the material under examination, and the greater they are for the same class of material—*i.e.*, for material having approximately the same tensile strength and elastic limit—the softer and more ductile the material may, as a rule, be considered.

12. *Elongation.*—This is the increase in length which a metal bar undergoes when subjected to a gradually applied tensile stress, in the direction of its length, sufficient to cause fracture.

It is usually expressed as the percentage increase on the original length of the bar. This elongation of the bar takes place equally throughout its entire length as long as the load is maintained well within the elastic limit, but as soon as this is much exceeded, the bar elongates somewhat unequally in different parts, and the ultimate elongation expressed in percentages is simply the sum of these variable local elongations.

13.

13. *Observations and measurements to be made in ordinary commercial machine testing* (*Professor Harbord*).—Details of testing an ordinary flat bar :—

Size :—

Thickness, mean of 6 readings = 0·4815 inch.
Width, do. 4 do. = 2·995 inches.
Area, = 2·995 x 0·4815 = 1·4421 sq. inch.
Maximum stress registered by machine, 50·83 tons.

$$\frac{50{\cdot}83}{1{\cdot}4421} = 35{\cdot}26 \text{ tons per sq. inch.}$$

Elastic limit registered by machine 32·5 tons.

$$\frac{32\,5}{1{\cdot}4421} = 22\,54 \text{ tons per sq. inch.}$$

Contraction of area :—

Thickness of plate at fracture, mean of 4 readings = 0·368 inch.
Width of plate at fracture, mean of 2 readings = 2·4375 inches.
Contracted area = 2·4375 x 0·368 = 0·897 sq. inches.

Original area = 1·4421
Contracted area = 0·8970

difference $\frac{0{\cdot}5451 \times 100}{1{\cdot}4421} = 37{\cdot}79$ per cent. contraction of area.

Elongation.

Length after fracture to be measured as will be described in another section. = 10·13 inches.

Original length ... ... = 8·00 inches.

difference 2·13 inches.

$$\frac{2{\cdot}13 \times 100}{8} = 26{\cdot}62 \text{ per cent. in 8 inches.}$$

We thus get :—

Ult. Tensile Strength.	Apparent Elastic Limit.	Contraction of Area per cent.	Total Elongation per cent. on 8 inches.
Tons per sq. inch. 35·26	Tons per sq. inch. 22·54	37·79	26·62

14. *Form of test bar used in commercial testing, and its effect upon the measurement of elongation.*—This subject has only of late years been taken up in England, and even to-day there is considerable confusion in the minds of many engineers when supplied with a test certificate, or the many tabulated records of experiments made to determine the ductility of iron and steel.

Taking, for instance, mild steel of an ultimate tensile strength of 25 tons per square inch, we find that the elongation is given, in one case, as a percentage on a length of 8 inches. In attempting to compare this result with another set of experiments, it is found that the elongation is given as a percentage of 10, and at other times 6 inches.

In many cases the elongation is simply given as so much per cent. ; and many costly and otherwise valuable records of investigations have lost their usefulness to engineers, owing to the impossibility of comparing them with results obtained from testing material about to be used.

Reference is rarely given to the ratio of length to diameter of the bar under test.

Mr. Kirkaldy stated in his *System of Testing* :—"Taking extreme examples, in the case of soft steel, a $\frac{1}{4}$ inch of round bar, the contraction of fracture is so local that the extension percentage would be barely affected by difference in length between 5 and 10 inches, but in a 3-inch round bar, the region of contraction extends about 5 inches, and, for a fair comparison to be possible between such, or even bars differing much less in size, the extension of the larger bar would need to be taken over a greater length than on the lesser"—in other words, there should be some definite ratio between the length and the diameter.

At the Eskbank Testing Office, repeated experiments have been made on 8-inch gauge lengths selected from bars of varying diameters, rolled from one ingot.

A bar of mild steel $\frac{3}{4}$ inch diameter was taken and scribed, as usual, with 1 g. = 8 inches. The measured length after fracture was 10 inches, giving an elongation of 25 per cent. on the 8 inches.

Taking now a bar $\frac{1}{4}$ inch diameter from the same ingot, the measured length, after fracture, was 9·4 inches, or an ultimate elongation of only 17 5 per cent. on 8 inches.

The ratio of length to diameter in the case of the $\frac{3}{4}$-inch bar is 10·6, and in the case of the $\frac{1}{4}$-inch bar 32·00. Of course, it is impossible to expect similar percentage of elongation under these conditions.

If the specification called for a minimum elongation of 25 per cent. in 8 inches, the $\frac{1}{4}$-inch bar would not, if measured in this way, come up to requirements, although the $\frac{3}{4}$-inch bar made from identical material fulfilled the conditions.

That some standard form of test bar and uniform system of measurement is necessary for the proper understanding of the properties of materials, has long been recognised.

Unfortunately, the leading authorities on the testing of materials are not yet agreed upon the best methods to be adopted to reach this end.

The Engineering Standards Committee have issued several reports dealing with the forms of test bars, and the influence of gauge length on the percentage of elongation. The Committee have also published lithographs, entitled *Form of Standard Test Pieces, June*, 1904. These forms are not by any means complete, and leave all questions of tapers, enlarged ends, fillets, &c., to be settled by the various

establishments

establishments using testing machines. In the case of test piece "B," given as the standard for bars, rods and stays, it is provided that the "gauge length must be parallel for a length not less than eight times the diameter."

This, of course, is necessary, as the flow of metal extends over a length equal to about these proportions, and the gauge length should exceed this, or the flow of metal is retarded, and the maximum breaking load increased.

15. *System adopted by Mr. David Kirkaldy for comparing the ultimate strength and elongation of wrought-iron bars* (See Table VIII, *Appendix* VII)—In all experiments made by Mr. Kirkaldy to ascertain the ultimate tensile strength of iron and steel, *the extensions were always recorded at definite stages during test, the ultimate extension being also given.*

Mr. Kirkaldy states:—"To try and compare the behaviour of iron or any metal entirely by the ultimate extension will only lead to difficulties, involving as it does a complex and not a simple question. Ultimate extension is affected very much by (*a*) the amount of contraction which ensues in the vicinity of, and at the fracture; (*b*) the distance upon which it is measured; and (*c*) the breaking stress, which is of a variable and not by any means equal amount. Whereas the system employed overcomes the difficulties by dealing with the question while the conditions are simple. At the stages, or amounts of stress, adopted by these comparisons the results or extensions can be compared with exactness right down the column, as they are not affected by the contraction of the specimen, because that had not set in to any extent. It is well to omit comparisons under the last or highest stress column in cases where that stress is close upon the ultimate. Moreover, the length of specimen does not affect the extensions, as they are practically uniform along the whole length, at those stages which are in advance of, or earlier than, the period when the extension becomes extreme. The extreme, or greater proportion of the extension is due to extra contraction setting in at locality of fracture, but which only happens close upon the ultimate. Further, the size or diameter of specimens does not vitiate the comparison under this system, which is of great consequence. Without such a method, when everything is left to hang upon the ultimate extension, the case is very different, because a large bar will contract over a greater region about the fracture than a small one."

This system, which is clearly shown in Table VII was no doubt of great service to Mr. Kirkaldy in his own works, but for ordinary commercial testing it is not convenient to note the percentage of elongation at definite stages or amounts of stress.

The engineer in charge of works receiving many test sheets weekly, covering the results of testing varied qualities and kinds of material, would not have previous results always at hand for comparison, and he concerns himself with the minimum ultimate elongation only.

Reference to the column headed "Elongation per cent. in 10 inches" in this Table VII will explain what is meant by the difficulty in making comparison between the material tested on this occasion by Mr. Kirkaldy and similar material tested by another engineer at a different time.

Take for instance tests M 949, 948, and 947 of 2½-inch diameter "Lowmoor" iron, having an average ultimate breaking stress of 22·7 tons. The elongations are given for the three tests referred to, as 24·3, 29·5, and 29·2 per cent. respectively in a length of 10 inches.

The ratio of length to diameter in this case is about 6·2.

Mr. Kirkaldy adopted the plan of making the test piece advance in diameter proportionately with the original size of the bar being tested.

The larger the diameter of bar, the larger the test piece. As, however, the gauge length was kept fixed at 10 inches there was a continued variation in the ratio, length to diameter.

Now, if an engineer was supplied with a test sheet of "Lowmoor" iron of similar tensile strength, and wished to compare the ultimate elongations obtained with those obtained by Mr. Kirkaldy, he would have some difficulty in doing so, if the new test sheet gave the ultimate elongations as a percentage on a 6-inch gauge length and a different diameter of test piece.

It is interesting at this point to compare Mr. Kirkaldy's figures in Table VII with Table IV (*Appendix* IV). This latter table gives the result of testing "Lowmoor" iron at the Government Testing Office, Eskbank.

Although test bars were used with sectional areas ranging from ·125 square inch to 1·00 square inch, the elongations obtained were practically identical. This table shows clearly the factors used in forming the bars. Test B308 turned to standard D is the standard bar, the others A, B, C and E, F are proportional bars, all having a gauge length $=11{\cdot}3\sqrt{a}$.

The advantage possessed by a method such as this will be apparent to all engineers.

The system on which this table was framed will now be explained in detail.

System adopted in the Government Testing Office, Eskbank, for comparing the Ultimate Strength and Elongation of Wrought Iron and Steel.

16. *Professor Martens' methods.* ("*Handbook of testing materials.*" Wiley and Sons).—Professor Martens states:—"Under the assumption of a homogeneous material it may certainly be expected that it will always suffer similar deformations under like circumstances; at least there is no forcible reason to expect other results; experience has demonstrated this 'law of similarities,' as was probably first verified by Lebasteur and Maire, 1878, for circular sections, and for rectangular sections by Barba in 1880, and was shown to apply between wide limits."

It may be expected that local extensibility is proportional to cross sectional dimensions, hence proportional to cross section area for similar shape and identical material. This assumption has been verified by many tests, and, therefore, *gauge lengths must vary as the square roots of sectional areas; when, similar bars of identical material, having different sectional areas, should show identical elongation.*

Bars of greatest possible length of identical material should be selected and their elongation (e %) determined from the measurement of previously scribed spaces, symmetrically located about the point of rupture.

Bauschinger compared all values of elongation determined with ratio $1\ g/\sqrt{a}=8{\cdot}5$. It was seen that dimensions and shape of section within the limits used by Bauschinger, *i.e.*, those which cover general practice in testing materials, had no material effect on elongation as long as the gauge length was made proportional to the square root of the sectional area. Bauschinger

Bauschinger, however, mainly used bars in which the finish or end length (length between the shoulders) exceeded the gauge length but slightly, and on which the heads (shoulders) were approximately similar.

The law of similarity, as Barba called it, or the law of proportional resistances, as Kick named it from a broader point of view, can be formulated for the case in hand as follows :—" *Under identical conditions and stress, bodies of identical material and of geometrically similar shape undergo geometrically similar deformations.*"

It has been confirmed by numerous tests of early and recent authors that the influence of section and shape of bar, within the practical limits of dimensions, and within the limits of lg (8 to 17) $\sqrt{a}$ for all points observed, as well as deformations e and e%, is very slight, as long as e% is determined from lengths which are proportional in all bars to $\sqrt{a}$.

It is, however, still largely customary to determine extension after fracture by measuring the change of gauge length (lg) between two scribe or punch marks, abutting the two parts of the broken test piece against against each other.

This extension, expressed in % of gauge length, has been designated "*ultimate elongation*," or e% of the material.

This method of measuring extensions, much used in practice is, however, subject to notable errors, independent of the error of instruments used, which must be designated as errors of method. It should be avoided.

17. *Report on the influence of gauge length and section of test bar on the percentage of elongation, by Professor W. C. Unwin* (Engineering Standards Committee).—This report will be referred to later on when dealing with flat bars and plates. (See Sections 24 to 33.) The following passages are, however, extracted :—

Page 3. " For any given test bar the elongation in a gauge length (lg) is made up of two parts ; one due to the general extension between the gauge points, which is proportional to lg, and the other due to the local contraction, which is nearly independent of lg. It is obvious then that the percentage of elongation diminishes for any given size of bar as the gauge length is increased. This has been long clearly enough recognised. It has not been so generally recognised that the elongation due to local contraction depends on the cross section of the test bar, and that, therefore, for a given gauge length, the percentage of elongation varies with the cross section of the test bar, and increased for a given gauge length as the cross section increases.

Page 4. In the case of bars differing in size it is found that geometrically similar bars deform similarly, and are still geometrically similar after deformation.

The general law that similar test bars deform similarly when broken by tension was first proved by M. Barba (Resistance des Marteriaux, Memoires de la Soc. des Ing. Civiles, 1880.) It follows that *for cylindrical test bars the percentage of elongation is constant for a given material when the ratio of gauge length to square root of cross section is constant.*

Page 6. *The Committee of Materials used in Ships and their Machinery* have decided on an 8-inch gauge length. The percentages of elongation have been measured for an 8-inch gauge length, and for bars of one half square inch section ($lg = 11{\cdot}3\sqrt{a}$), which is the German Standard form.

The law of proportional resistances. Experiments made at the Government Testing Office, Eskbank, on iron and steel locally manufactured, and on imported " Lowmoor " iron.

18. *Standard Bars for round Specimens.*—Plate No. 3, Standard " d " (*Appendix* X), gives the standard round bar adopted by the Government Testing Office, Eskbank. This bar is practically identical with the standard round bar used at the Charlottenburg Testing Laboratory controlled by Professor Martens. The diameter is fixed at ·798 instead of ·8, the former being the nearest to ·5 sectional area, which is a convenient factor for use. The parallel portion has also been altered to 9 inches instead of 8·8 inches. The length of shoulders is, of course, made to suit the form of grip in use. It should be as long as possible. A short piece held in the Olsen Machine is liable to injure the grips.

Proportional bars are given the dimensions shown on Standards a, b, c, e, and f, based on $\sqrt{a}$ as unity. Gauge length $lg = 11{\cdot}3\sqrt{a}$. In all cases the gauge length is divided into 8 equal spaces by means of standard gauges, see Fig. 1, page 99. The preparation and manipulation of these test bars is very simple when once the system is understood. It will be seen that the standards " a " to " f " cover a wide range, and have been found to answer most of the requirements of commercial testing.

When test bars are required to be selected from material having a smaller sectional area than required for the standard bar " D," or proportional bars " a," " b," or " c," the forms given on Plate 2 (*Appendix* IX) are used.

These partially turned bars, and bars tested without any preparation whatever, will be dealt with in another section, where it will be shown that the influence of section and shape of the bar is very slight, as long as e% is determined from lengths which are proportional in all bars to $\sqrt{a}$.

19. *Testing the Standard Bar (d) and Proportional Bars Prepared to Forms* $lg = 11{\cdot}3\sqrt{a}$.—It may be considered superfluous to require further tests to verify the law of proportional resistances, after what has been already said, and considering the large number of similar experiments which have been made by Professor Unwin in England, Professor Martens in Germany, and more recently by Professor Warren in the Sydney University.

But it must be remembered that, with the establishment of the iron industry in Australia, it was of vital importance that a system of Commercial Testing should be introduced into the Government Testing Office, having at once the sanction of the leading scientific authorities on the testing of materials, and also the confidence of Australian Engineers. To fulfil the latter condition it was considered advisable to make a series of experiments with imported iron, and iron and steel manufactured in the State.

The results obtained were then tabulated, and, in addition, diagrams were prepared showing the gauge lengths before and after fracture, with clear instructions as to the methods used to determine the elongations. A bar of " Lowmoor " iron, of apparently even quality, $1\frac{1}{2}$ inch diameter was selected for the first experiment. From this bar six test specimens were prepared having the dimensions and forms given on Plate 3 (*Appendix* X).

The

The test-bars were marked A, B, C, D, E, F. ; specimen "D" being the standard bar. These bars were graduated on the gauge length as described in Section 21. They were then tested in the ordinary way for the tensile stress and apparent elastic limit, or yield point, as the latter observation might be termed in commercial testing.

Table IV (*Appendix* IV) gives the detail results of these experiments.

It will be noticed that the bar having the smallest sectional area gave the smallest tensile stress. This is due to the fact that the small diameter of standard "A," ·399 inch, was turned down from $1\frac{1}{2}$ inch bar, thereby exposing as it were the very centre or core of the iron.

To verify this assumption, another length was cut from the same bar, and a test piece was made to the same form as standard "A," but instead of centering the bar in the lathe, it was chucked eccentrically, thereby allowing the gauge length to come nearer to the outside fibres of the original bar. The tensile stress given by this bar was almost exactly that of the standard bar "D."

It will be noticed also that the elongation of bar "A," as originally turned from the centre of bar, was the lowest in the series. Here again it was found that the eccentrically turned bar gave an improved elongation, practically identical with standard "D."

The results of the test pieces turned from the centre of bar were retained in the tables; as in actual practice in testing, a test piece would be selected to the standard nearest to the original size of the bar experimented upon.

Eccentric turning is only resorted to when the bars are of large diameter, and the proportional test bar ($11{\cdot}3\sqrt{a}$) beyond the limits of the testing machine.

The average ultimate tensile stress of 6 bars was 21·64 tons per sq. inch; the greatest difference being 2·81 tons per sq. inch. If we take out standard "A," the difference is reduced to 1·83 tons.

These differences will be found in any system of testing; different parts of one bar often giving slightly different results. Professor Martens states that "the difference of strength of pieces cut side by side from the same sheet are generally so great that the effect of speed in testing lies within the errors."

20. *Measuring the Elongations.*—Reference to Table IV shows that the gauge lengths of the 6 bars tested ranged from 4 inches to 11·25 inches. The elongation per cent. on lg was practically constant throughout; ranging from 28·51% for standard "A" to 30·31 for standard "F," or a difference of 1·80%. If we eliminate standard "A" for the reasons already explained, the difference is only 1·16%, which is well within the limit of ordinary everyday work. The average elongation for the 6 specimens was 29·56%.

21. *Elongation on Gauge Length Measured Symmetrically with Fracture.*—Professor Martens states (see Section 19) the percentage of elongation (e%) should be determined from the measurement of previously scribed spaces, *symmetrically located about the point of rupture.*

Convincing proof has been obtained that elongations of different parts of bars are very markedly different, according to their difference from the point of rupture.

The inappropriateness of the common method of measuring the change of gauge length lg between two punch marks can thus be readily adduced.

It can also be seen that the measured extensibility must be a maximum when rupture occurs at the centre of lg, and a minimum when occurring at the ends.

Professor Martens further states that:—"Under the practically permissible assumption that deformations are symmetrically about the point of rupture, there is one method of procedure which gives accurate values for extensibility of materials under all conditions, excluding the certainly insignificant errors of the assumption."

In order to carry out this method practically, the public and scientific laboratories provide tension test-bars with spaces, which are either marked by the double punch, or scribed by using a special spacing gauge, similar to fig 1.

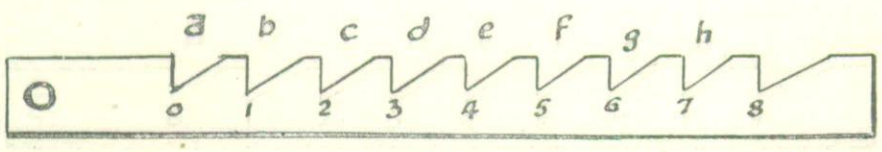


Fig. 1.

When rupture occurs at any one of these divisions, merely counting the spaces will locate those points which were originally equivalent from the point of fracture. If the fracture occurred say at "c," Fig 1, the extension of the spaces missing at the short end, measured from those correspondingly situated on the long end, will supplement the measured extension according to the above described method.

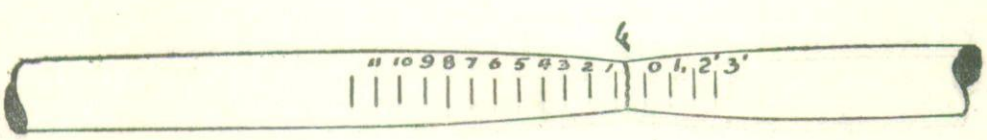


Fig. 2.

If, as in Fig 2, rupture occurred between lines 0 and 1, then measurements of (0 to 10 + 0 to 3′ + 3 to 10) − lg for $\frac{lg}{20}$ parts will give (e) and hence :—

$$e\,\% = \frac{e}{lg} \cdot 100 \text{ by calculation.}$$

This practically agrees with the method used in the Government Testing Office, Eskbank, which is taken from that recommended by Professor Unwin.

Taking standard "c," Plate 3 (*Appendix* X) the following readings are taken after fracture on the bar having 8 divisions:—lg = 5·75 before fracture. (*See also Table IV, and Plate* 1.)

The

The fracture is shown in the 3rd division.

Extension in 3rd division (fracture) } Extensions in divisions 1, 2, 4, 5	= a + b + c + d + e =	4·79 in.
Double extension in division 6	= f × 2 =	1·78 in.
Extension in division 7	= g =	·87 in.
Total for 8 divisions symmetrically with fracture		7·44 in.

$$7{\cdot}44 - 5{\cdot}75 = 1{\cdot}69 = e.$$

$$e\% = \frac{1{\cdot}69 \times 100}{5{\cdot}75} = 29{\cdot}39 \text{ per cent. elongation.}$$

22. *Fish-plates and Rail Connections.*—The form of test bar most adapted for fish-plates is standard "b." (*Appendix* X.)

This piece can be conveniently turned from the root of the plate, and gives $\frac{1}{3}$ sq. inch under stress. This, or practically similar form, has been recommended by Professor Warren of the Sydney University.

For a tensile stress of 75,000 to 85,000 lb. per square inch the specified elongation should not be less than 20 % in lg = $11{\cdot}3\sqrt{a}$. The parallel gauge length of standard "b" is 5 inches. (See Section No. 39. Standards of quality.)

Table III (*Appendix* III) gives a series of tests on fishplate steel manufactured at Eskbank, having a tensile stress ranging from 75,700 lb. to 77,200 lb. per sq. inch, with sectional areas ranging from ·385 to ·500 sq. inch.

The average elongation for six specimens was 22·39 % on lg, in all cases proportional to $\sqrt{a}$.

To illustrate the difficulty previously referred to in making comparisons between two sets of recorded experiments, reference might be made to Table III (*Appendix* III), and Table VI (*Appendix* VI).

Table III, covering experiments of fish-plate steel of average tensile strength of 34·2 tons per sq. inch, gives an average of 22·39 % elongation of lg = $11{\cdot}3\sqrt{a}$.

In Table VI Professor Harbord gives a series of experiments of steel having varying tensile stresses.

Test Nos. 45 and 46 give ultimate stresses of 34 00 and 34·37 tons per sq. inch respectively, with ·35 and ·36 carbon (basic). The elongation is given as 22·40 and 22·13 % on 6 inches.

Professor Harbord is careful to give the gauge length, and the diameter of bars tested, and we arrive at the ratio length to diameter as 8·57, and lg = $9{\cdot}67\sqrt{a}$.

As these measurements differed from the Government Testing Office Standards an exact comparison could not be made.

Certainly the difference in the parallel length of the bars was trifling. Professor Harbord used bars of ·700 inch diameter, with lg = 6 inches.

A bar ·700 inch diam., proportioned on the value of $11{\cdot}3\sqrt{a}$, would give a bar lg = 7·00. (See Tests Nos. 332 and 333, Table III). Bars were, however, made at Eskbank exactly to the dimensions given by Professor Harbord. (See Tests 328 and 329, Table III.) These bars, with practically the same tensile stress and contained carbon as the six bars previously tested, gave the slightly higher elongation of 22·63 % on lg = $9{\cdot}67\sqrt{a}$. The slight increase was to be expected, using the shorter bar. Table III also gives the result of testing fishplate steel of the same tensile strength, but using 2-inch gauge lengths not proportional to standard. Tests Nos. 338 and 339 gave an average elongation of 29·12 % on 2 inches.

Steel of this grade carbon usually gives about 30 per cent. elongation in 2 inches. This gauge length should be avoided in dealing with mild or structural steel, as it cannot be compared with the standards used for ordinary work. It is always desirable to use, for structural steel, the uniform standards proportional to $\sqrt{a}$.

By this means a close relation is soon established between the steel furnace and the testing works. When once it is established that a certain carbon will produce a certain ultimate tensile stress and elongation in the steel, the furnace men can work in greater confidence. Practically a standard analysis is established for each specified test of steel, and it is of the utmost importance that clearly established Standard Test Bars are used in the work of testing and reporting upon them.

23. *Short Gauge length for High Carbon Steel.*—The Engineering Standards Committee provide for a 2-inch gauge length for hard steels, where, in such cases as tyres, castings, &c., it is generally difficult to cut a long specimen.

This standard of 2 inches should be kept therefore for high carbon steels, and a new set of tables prepared covering the special values obtained by the laboratory and testing machine.

24. *Standard bars for round specimens, testing standard bars turned on gauge length only, and rough bars parallel for full length.*—In Commercial Testing, where the quality of very large quantities of iron and steel has to be determined daily, it is not always possible to use the finished form of test bar "a," "b," "c," "d" and "e," shown on Plate 3, *Appendix* X. The time occupied in turning one of these specimens is considerable, and the cost soon becomes a serious item. It would require several lathes to keep the Eskbank Works, under present conditions, supplied promptly with a sufficient quantity of these finished bars for a day's routine work.

Work must go on expeditiously in the Testing Office, otherwise the yards would quickly fill with large quantities of material awaiting the Engineer's decision before branding with the quality or test number.

To meet these conditions it was necessary to adopt a system whereby the maximum of scientific accuracy could be obtained in the minimum time.

In many of the Rolling Mills of England, the form of test bar used is shown on Plate 3, *Appendix* X, Test Bars "h" and "j."

In many works the gauge length is fixed at 8 inches, with very little space between the end scribe marks and the shoulders.

If the test bars and the material tested were constant quantities, the comparative results obtained would no doubt meet practical requirements. The results however would be very unsatisfactory if the material tested ranged in diameter from, say $\frac{1}{4}$ inch to 4 inches. The effect of grips then becomes a serious matter, and, as already explained, the fixed gauge length on varying diameters makes the correct determination of the ductility impossible.

Table

Table IV gives the results of testing bars "a," "b," "c," "d," "e," "f," "g," "h," and "j," all cut from one bar of selected "Lowmoor" iron.

Standard "D" and the proportional bars "a," "b," "c," "e," and "f," are practically identical in results; standard "a" being slightly below normal for the reasons already explained.

Test bars "H" and "J," not proportional to standard, gave the lowest tensile stress and elongation respectively of the series. Both results are obviously wrong.

It will be noticed that both these bars were prepared with $lg = 11{\cdot}3\sqrt{a}$.

The important difference between these bars and the standards "a" to "f" lies in the distance between grips.

Standards "a" to "f" are proportioned on the standard distance between grips $L = 20\sqrt{a}$. (See Table I, *Appendix* I.)

Bars "H" and "J" are turned with a space of only about $\frac{3}{4}$ inch between the end scribe mark and the grips, which is the common practice with such forms.

Sufficient has been said to show that bars of this form having no proper ratio,—length to diameter, as regards the distance between grips, should not be accepted as regular standards.

Table V gives the dimensions of standard partially turned specimens "p," "q," "r," "s," "t," "u," illustrated on Plate 2, *Appendix* IX, which have been adopted for use in the Government Testing Office, Eskbank, after careful examination and comparative experiments. It will be noticed that the series covers a wide range of diameters, and that the turned portion is only slightly longer than the gauge length, the remainder of the bar being left in its original condition as received from the rolls.

The gauge length is proportional in exact accordance with the Standard Bars "a" to "f," Plate 3.

$$Lg = 11{\cdot}3\sqrt{a}.$$

The turned length is also proportional with the $\sqrt{a}$, the multiple being fixed at 14.

$$\text{Turned length } T = 14\sqrt{a}.$$

To follow somewhat the proportions of standard bars "a" to "f," the distance between grips might have been made the same, *viz.*:—

$$L = 20\sqrt{a}.$$

Numerous experiments were made, however, and it was found that by reducing the distance between grips proportionately did not make any noticeable difference in the results.

Considering the limits of extension of a 50-ton machine, the length between grips was finally fixed with a multiple of $18\sqrt{a}$.

$$L = 18\sqrt{a}.$$

Table XII, *Appendix* XII, gives the results of testing a series of these partially turned bars, all cut from one bar of B.B.B. or No. 2 test Eskbank iron.

To enable a comparison to be made with the fixed standard, one test piece was first cut from the bar, and accurately turned up to the Government Testing Office Standard "D," this being the standard to which all other test pieces are referred.

The form is shown on Plate 3:—

$$lg = 11{\cdot}3\sqrt{a}.$$
$$L = 12{\cdot}5\sqrt{a}.$$
$$\text{Between grips } 20\sqrt{a}.$$

It will be seen from Table XII that the results are remarkably even, the figures being closer than those obtained by the experiment on "Lowmoor" iron given in Table IV.

Standard "D," and the partially turned standards "q," "r," "s," "t," "u," are for all practical purposes exactly the same, both as regards the ultimate tensile stress and the elongation.

With results such as these, it is quite consistent to accept forms "p" to "u" as recognised standards for daily use.

They meet most scientific requirements, and are vastly cheaper than the standards "a" to "f" with long taper ends, accurate fillets, and shoulders.

Of course it is not intended to banish the scientifically accurate standard "d" and the proportional bars of similar shape from the Testing Office. They will still be used on important work at intervals, as occasion demands.

25. *Testing Bars direct from the Rolling Mills without preparation.—Proportionate Gauge Lengths, and Lengths between Grips.*—Following out the reasoning on the subject of proportional resistances, a further step was taken.

If partially turned bars, with lg proportional to $\sqrt{a}$, gave such close results to the completely finished standard bars, it was considered advisable to inquire how far rough bars, taken directly from the mills, would agree if tested under similar conditions and measurements as regards $\sqrt{a}$.

Table II gives the measurement finally decided upon.

Here there were only two lengths to consider, viz., the gauge length, lg, and the length between grips; all to be proportional to $\sqrt{a}$.

The gauge length was of course again fixed as $lg = 11{\cdot}3\sqrt{a}$. The distance between grips was fixed at $16\sqrt{a}$, being slightly shorter than that of the partially turned bar.

Here again the limits of extension between grips of a 50-ton machine to a certain extent influenced the multiple of 16. If possible 1 in. or $1\frac{1}{8}$ in. diameter should be tested in the rough when required; but if a multiple of $20\sqrt{a}$ was adopted, as in the case of the standard bars, the machine would not take in the material requiring, say, 30 per cent. elongation in lg.

The fully turned standards "e" and "f" were for this reason tested at the Sydney University on a larger machine.

In actual practice, of course standards "e" and "f" need not be used unless a 100-ton machine is available. With only a 50-ton machine in use, the specimens would be turned to (say) standard "d," unless material requiring a larger diameter was under examination, when standard "d," or even "t," would be turned eccentrically from the large area bar, as explained in a former chapter.

On

On Table XII, *Appendix* XII, is given the results of testing two pieces cut from a bar of Eskbank B.B.B. iron similar to that used for the experiments on the partially turned standard bars. Here again it will be seen that the tensile stress and elongation are practically identical with the standards.

Of course there are some objections to testing specimens direct from the rolls without previous preparation. The bars are not always truly round, and there is considerable difficulty in obtaining a correct measurement of the area under test. Then without any reduction in the area of bar the most likely place for the specimen to break would be in or near the grips. As a rule, this means testing another piece, as the elongation cannot be properly measured, nor the recorded tensile stress relied upon.

It is advisable, therefore, in most cases of rapid commercial testing, to use the partially turned specimens, which take but a short time to prepare, and which give results that can be thoroughly relied upon over very wide limits.

26. *Flat Test Pieces for Plates and Bars.*—The lithograph of "Forms of Standard Test Pieces" before referred to, published by the Engineering Standards Committee, shows a test piece "A" for plate and other structural material.

The test piece has a fixed gauge length of 8 inches, but three different widths as follows:—

1. For thickness under ·375 inches, maximum width allowed, $2\frac{1}{2}$ inches.
2. For thickness ·375 inches to ·875 inch, maximum width allowed, 2 inches.
3. For thickness over ·875 inch, maximum width allowed, $1\frac{1}{2}$ inches.

Now it will be seen on reference to Plate 4 (*Appendix* XI), that with a fixed gauge length of 8 inches the only bars that would be approximate to $11{\cdot}3\sqrt{a}$ would be $2\frac{1}{2}$ in. x $\frac{3}{16}$ in. = area ·469 inch, and $2\frac{1}{2}$ in. x 7/32 in. = area ·547 inch.

By accepting the reasoning given on the preceding pages as to the law of Proportional Resistances, it would appear that excepting the above two dimensions, all other bars should be longer or shorter than $1g = 8$ inches.

No explanation is given on the published lithograph as to how this test piece "A" for flats would compare with test piece "B" for rounds, using a standard or proportional bar in the latter case, and one not proportional in the former.

Without some explanation on this point engineers are still faced with the difficulty in making comparisons of ductility. Special attention must therefore be given to these flat specimens for plates and bars, and the reasons which influenced the Engineering Standards Committee in deciding to accept test piece "A" as the standard.

There is no doubt that the standard was adopted by the Committee after considering the special investigations and report made by Professor Unwin.

This report was entitled "*The influence of gauge length and section of test bar on the percentage of elongation,*" and although touching upon geometrically similar bars, is confined principally to investigations into the ductility of ship and boiler plates, and the form of test bar required in their testing.

Professor Unwin states in his opening chapter:—"The difficulty of comparing the elongation of different test bars would disappear, if only the general elongations were measured, that is, the elongation at the moment of maximum load, before local contraction begins. There is no easy way of doing this except by taking an autograph diagram of each test, and this is not practically possible in ordinary testing"

This comparison of general elongation up to maximum load was the system advocated by Mr. Kirkaldy. (See section 18.)

It is quite impracticable in commercial testing.

27. *Standard Flat Test Pieces.*—The reader is referred to Professor Unwin's report for the special investigations which led up to a practical conclusion. It is advisable, however, to quote here three general rules adopted in settling the standard forms of flat test bars, and the practical objections to rigidly applying them.

28. (*a*) *Gauge Length varied, so that $l/\sqrt{a}$ is kept constant whatever the section of the bar.*—If the gauge length is varied (as in Standard Round Bars) most of the difficulty in applying the principle of "geometrically similar" test bars vanishes. In fact, in Germany, when the standard form of half inch section and eight inch gauge length is departed from, proportional bars are used; the gauge length being varied so that the standard relation $l = 11{\cdot}3\sqrt{a}$ is still complied with. But the Committee have decided on a fixed gauge-length, and the objections on the ground of cost to a variable gauge length (for flat bars) seem insuperable in commercial tests.

29. (*b*) *Fixed Gauge Length and Fixed Area of Section of Test Bar.*—If this rule were adopted, a section of $\frac{1}{2}$ square inch, or 1 square inch, might be adopted for an 8-inch gauge length, or, since it has been shown that the difference of percentage of elongation in $\frac{1}{2}$-inch and 1-inch bars is under 3 per cent., standard (flat) bars might be defined as bars of 8-inch gauge length, and not more than 1 square inch or less than $\frac{1}{2}$ square inch section.

This rule would be quite satisfactory from the scientific point of view.

It will be seen also from Plate 4 (*Appendix* XI) that this rule would take in plates or bars from $\frac{3}{16}$ inch to $\frac{1}{2}$ inch thick, using widths of $2\frac{1}{2}$ inches and 2 inches respectively.

Professor Unwin states:—"Practically it would be inconvenient for very thin and very thick plates."

Thickness of Plate.	Width of Test Bars.	
	0·5 square inch in area.	1·0 square inch in area.
$\frac{1}{4}$ inch	2·00	4·00
$\frac{5}{16}$,,	1·33	2·66
$\frac{3}{8}$,,	0·80	1·60
$\frac{7}{8}$,,	0·57	1·14
$1\frac{1}{4}$,,	0·40	0·80
$1\frac{1}{2}$,,	0·33	0·66

It will readily be seen that not only would this system be inconvenient, but its cost would be prohibitive. In commercial testing, such as required at Eskbank, flat bars of a wide range of widths and thickness are being dealt with daily. It would be a very costly matter to machine these bars to constantly varying widths. Further, time would not, as a rule, permit of this being done.

30. (c) *Fixed Gauge Length and Fixed Width of Test Bar.*—There is a practical objection to carrying out this rule rigidly also, namely, that for very thick plates the section-area is so large that ordinary testing machines will not break the test-bars.

The discussion seems to show that, if plates of all thicknesses are considered, from the thinnest to the thickest, no one rule can be rigidly adopted, and there must be a compromise. Now, by far the greatest weight of plates manufactured are between $\frac{3}{8}$ inch and $\frac{7}{8}$ inch thick (inclusive).

If standard proportions could be settled for these plates first, then necessary modifications for thinner and thicker plates could easily be arranged.

At the Government Testing Office, bars and plates of $\frac{7}{8}$ inch and over are usually slit by the cold saw, and a standard round bar prepared.

31. *General Form of Flat Test Bars.*—Again quoting from Professor Unwin's report, it is stated :—"If the question of width of test-bar is put aside for the moment, there is not much room for discussion as to the general form of test-bar. The only point which should be borne in mind is, that nearness of enlarged ends to the gauge length diminishes the percentage of elongation. Hence the parallel part should be rather longer than the gauge length, and curves should join the parallel part to the enlarged ends."

The form recommended is shown on Plate 4 (*Appendix* XI).

32. *Suggested Standards for Flat Bars* (Professor Unwin).—Plan 1. The plan which would accord best with the scientific principle that the tests should show the real quality of the material would be this:—

For plates from $\frac{3}{8}$ inch to $\frac{7}{8}$ inch in thickness (inclusive), the gauge length shall be 8 inches, and the cross section of the test-bar shall not exceed 1 square inch.

The following table shows some cases of this rule :—

Thickness of Plate.	Greatest width of Test Bar.	Value of $\frac{l}{\sqrt{a}}$	Elongation per cent. in the Test made.	
			Ship Plates.	Boiler Plates.
$\frac{3}{8}$ inch	$2\frac{3}{8}$ inches	8·0	29·1	29·4
$\frac{1}{2}$ to $\frac{5}{8}$,,	$1\frac{3}{8}$,,	8·0	26·6	28·5
$\frac{3}{4}$ to $\frac{7}{8}$,,	$1\frac{1}{7}$,,	8·0	24·9	27·2

All such bars would break in 50-ton machines. For very thin plates it would be desirable to fix a rather less maximum area, and for plates above $\frac{7}{8}$ inch thick, a rather larger area.

33. *Plan II. This was adopted by the Engineering Standards Committee, and forms the Standard in use in the Government Testing Office, Eskbank.*—The plan may be adopted of fixing the maximum width of test-bar. The rule might then be as follows :—

For plates from $\frac{3}{8}$ inch to $\frac{7}{8}$ inch inclusive, the gauge length shall be 8 inches, and the width of test-bar not more than 2 inches. (See Standard "N," Plate 4, *Appendix* XI.)

If possible and convenient, when handling merchant bars of varying sizes, the width of parallel portion is reduced in accordance with advancing thickness, keeping thereby the sectional area approximately 1 square inch.

The following table gives some cases of Plan II.

Thickness of Plate.	Greatest width of of Test Bar.	Value of $\frac{l}{\sqrt{a}}$	Elongation per cent. in the Tests made.	
			Ship Plates.	Boiler Plate.
inches.	inches.			
$\frac{3}{8}$ to $\frac{5}{8}$	2	9·2	27·7	28·2
$\frac{5}{8}$ to $\frac{7}{8}$	2	7·2	27·5	29·5
$\frac{7}{8}$	2	6·1	27·7	30·0

For plates of less than $\frac{3}{8}$ inch thick, it would be better to make the greatest width $2\frac{1}{2}$ inches. (See Standard "M," plate 4, *Appendix* XI.)

For plates more than $\frac{7}{8}$ inch thick, the maximum width should be $1\frac{1}{2}$ inches.

The report by Professor Unwin gives a large number of comparative tests of ship and boiler plates ranging from $\frac{1}{4}$ inch to $1\frac{1}{4}$ inches in thickness, supplied by the Dalzell Steel Works, and the Parkgate Steel Works. No such complete information as to variation of elongation with the form of test-bar has been previously available.

The tables are conveniently summarised as follows :—

34.—Table IX.

Ship's Plates $\frac{1}{4}$ inch to $1\frac{1}{4}$ inches thick. Mean Elongation of all plates tested.

Thickness.	Mean Elongation per cent. for $lg = 11{\cdot}3\sqrt{a}$.	Mean Elongation per cent. for $lg = 8\sqrt{a}$.	Mean Elongation per cent. in 8 inches. Constant width of $1\frac{1}{2}$ inches.	Mean Elongation per cent. in 8 inches Constant width of 2 inches.	Mean Elongation per cent. in 8 inches. Constant width of $2\frac{1}{2}$ inches.
$\frac{1}{4}$" inch	22·7	25·4	21·7	22·7	23·5
$\frac{3}{8}$" ,, ...	26·0	29·1	26·4	27·7	28·9
$\frac{5}{8}$" ,, ...	24·7	26·6	26·4	27·5	28·6
$\frac{7}{8}$" ,, ...	22·3	24·9	26·2	27·7	28·9
$1\frac{1}{4}$" ,, ...	19·8	22·6	25·2	26·3	27·3
Mean of all	23·1	25·7	25·2	26·4	27·3

35.—TABLE X.

Boiler Plates ¼ inch to 1¼ inches thick. Mean Elongation of all bars tested.

Thickness.	Mean Elongation per cent. for $lg = 11{\cdot}3\sqrt{a}$.	Mean Elongation per cent. for $lg = 8\sqrt{a}$.	Mean Elongation per cent. in 8 inches. Constant width of 1½ inches.	Mean Elongation per cent. in 8 inches Constant width of 2 inches.	Mean Elongation per cent. in 8 inches. Constant width of 2½ inches.
¼" inch	22·7	26·2	20 9	22·7	23·7
⅜" ,,	26·0	29·4	27 1	28·2	29·2
½" ,,	25·6	28·5	28·2	29·5	30·8
⅞" ,,	24·3	27·2	28·6	30·0	31·3
1¼" ,,	24·6	27·4	30·6	32 1	33·8
Mean of all	24·8	27·7	27·1	28·5	29·8

Tests across the plates are excluded in the case of 1¼ inch thick bars. From ¼ inch to ⅞ inch the results include tests made with and also across the plates.

Standards of Quality.

36. *Coefficients of Quality.*—It will be seen from Table XI (paragraph 38, Coefficients of Quality), covering a fairly wide range of structural steel, that an increase of ultimate tensile stress (S) is accompanied by a fairly uniform decrease in elongation (e%).

In the case of acid steel, there is a marked even decrease in the contraction of area (r%) at fracture with the rise in tensile stress.

The contraction of area in basic steel opens up the question of chemical composition, which will be omitted here, as being beyond the scope of this paper.

In order to express the value of a material which decreases in ductility with an advance in tensile strength, various propositions have been made, the most important being that of Professor Tetmajer, who suggested a coefficient of quality.

(For further information on this point, see Report of the Committee of the Am. Soc. of Civil Engineers, 1896.)

Briefly, Professor Tetmajer's coefficient may be expressed as follows:—

let S_1 = Ultimate Stress in tons per square inch;
$e\%$ = Elongation per cent. in 8 inches;
C = Constant, obtained by experiment;
then $C = S_1 \times e\%$.

If we take steel of 75,000 lb. minimum ult. tensile stress, say 33·5 tons, with a maximum elongation of 20% in 8 inches, the coefficient becomes:—

$$C = S_1 \times e\% = 6{\cdot}7.$$

Referring now to Table XI, the following coefficients are obtained:—

	S_1.	S_1.	e%.	Coefficient of quality = C.
	lb.	tons.		
British Steel (acid)	74,704	33·35	23·26	7·75
,, (basic)	76,160	34·00	22·40	7·62
Eskbank Steel (acid)	75,700	33·80	21·87	7·39
,, (basic)	76,640	34·21	22·90	7·83

It will be seen, therefore, that this coefficient is useful in making a comparison of quality, and determining the elongation to be specified for structural and other steels.

The Committee of the Am. Soc. of Civil Engineers (Proceedings, 1896) recommended for structural steel—

From 56,000 to 74,000 lb. per square inch =
,, 25 to 32·4 tons per square inch (S_1);

that the elongation and reduction of area should not be less than obtained from the following formulas:—

$$e = \frac{1{,}500{,}000}{S_1}$$

$$r\% = \frac{2{,}800{,}000}{S_1}$$

where $e\%$ = elongation per cent. in 8 inches, and $r\%$ = reduction of area at fracture.

Taking again structural steel of 75,000 lb. per square inch, minimum tensile stress, and applying these formulas, we have:—

$$e\% = 20{\cdot}00 \text{ (Tetmajer's Coefficient} = 6{\cdot}7).$$

This is the minimum elongation recommended in section 25 for fishplate steel of this strength.

$$r\% = 37{\cdot}30.$$

It will be seen on reference to Table XI (paragraph 41) that the percentage of elongation obtained on British and Eskbank steel, exceeds in all cases the values obtained by the American formula.

The average of six specimens of Eskbank steel gave the following results:—

$$e\% = \frac{1{,}717{,}399}{76{,}644} = \frac{\text{Elongation per cent. in 8 inches.}}{22{\cdot}4}$$

Using Tetmajer's coefficient of quality, converting 76,644 into 34·21 tons, we have—

$$C = S_1 \times e\% = 34{\cdot}21 \times 22{\cdot}4 = 7{\cdot}66,$$

which is practically identical with the coefficient of British steel of the same tensile stress. 37.

37. *Mild Weldable Steel* for various engineering purposes. Constant calls are made for a very mild steel for welding purposes.

This usually contains ·10 to ·15 carbon, and has an ultimate tensile strength of 23 tons, which is about that of wrought-iron. For many purposes this material is vastly superior to wrought-iron of the best quality. It is stronger, more ductile, of even grain, and entirely free from laminations and other defects sometimes found in iron, the fibre of which is obtained by welding and rolling together a number of "rough-down" piles.

Its low carbon precludes molecular change by atmospheric conditions to any appreciable extent beyond that in wrought-iron under similar circumstances.

If now we take Tremajer's coefficient of quality as 6·7 in this case, the elongation (e%) should be :—

$$e\% = \frac{C}{S_1} = \frac{6{\cdot}7}{23} = 29{\cdot}13$$

A large number of samples of this quality steel have been tested at Eskbank, the elongation (e%) in 8 inches, or lg = $11{\cdot}3\sqrt{a}$, being usually about 30 per cent., which should be the minimum specified for this class of material.

$$\therefore C = S_1 \times e\% = 23 \times 30 = 6{\cdot}9.$$

38. Table XI.—Coefficients of Quality.

e% = elongation per cent. in 8 inches, or approx. on lg = $11{\cdot}3\sqrt{a}$.
lg = measured gauge length on test bar.
Ce = coefficient of quality (elongation).
S_1 = ultimate tensile stress.
r% = reduction of area.
Cr = coefficient of quality (contraction).

$$e\% = \frac{Ce}{S_1} \text{ or } Ce = e\% S_1$$

$$r\% = \frac{Cr}{S_1} \text{ or } Cr = r\% S_1$$

Coefficients of Quality.					Composition.				
S_1.	e%	Ce.	r%	Cr.	C.	Mn.	Si.	P.	S.
				Acid Steel (British).					
56,560	29·23	1,653,248	62·30	3,523,588	·132	·400	·026	·055	·031
58,688	29·80	1,748,902	61·80	3,616,918	·128	·530	·021	·058	·041
67,962	27·20	1,848,566	57·41	3,901,698	·183	·710	·037	·052	·024
74,704	23·26	1,737,615	52·04	3,887,596	·311	·575	·040	·052	·021
82,880	21·76	1,803,469	45·51	3,771,868	·370	·800	·062	·029	·021
				Basic Steel (British).					
59,987	25·56	1,533,267	43·59	2,614,733	·230	·450	·009	·054	·047
76,160	22·40	1,706,000	45·10	3,434,816	·355	·490	·014	·071	·046
78,400	20·90	1,638,560	45·10	3,535,840	·370	·660	·016	·054	·047
81,312	21·86	1,777,480	47·59	3,869,638	·368	·625	·039	·040	·044
82,880	18·76	1,554,830	43·80	3,830,144	·420	·575	·037	·041	·037
				Acid Steel (Eskbank).					
75,700	21·87	1,662,560	38·00	2,876,600	·260	.....	.....	.....	.....
77,200	22·62	1,746,264	32·40	2,501,280	·280	.....	.....	.....	.....
76,640	22·90	1,755,056	40·00	3,065,600	·290	.....	.....	.....	.....
77,000	23·70	1,824,900	44·00	3,388,000	·300	·520	·079	·063	·051
76,648	21·40	1,640,267	38·90	2,981,607	·260	.....	.....	.....	.....
76,675	21·85	1,675,348	38·90	2,982,657	·260	.....	.....	.....	.....
76,644	22·39	1,717,399	Average.						
				Low Carbon Steel (Basic), Eskbank.					
52,000	36·00	1,872,000	69·70	3,624,200	·130	.....	.....	.....	.....
58,929	31·24	1,840,941	61·20	3,606,454	·240	·470	.....	·015	·058
62,517	26·40	1,650,448	50·00	3,125,850	·200	.....	.....	.....	.....

Appendix I.

Table I.—Round Bars.

Turned to Standards.

Standard Specimen.	Diameter of gauge Length.	Area, a.	$\sqrt{a}$.	lg. = $11{\cdot}3\sqrt{a}$.	L = $12{\cdot}5\sqrt{a}$.	Between Grips, L = $20\cdot\sqrt{a}$.	$d_1 = 1{\cdot}5\sqrt{a}$.	$d_2 = 2\sqrt{a}$.
		Sq. in.					in.	in.
A.	·399	$\frac{1}{8}$ = ·125	·354	4·00	4·50	7·00	$\frac{17}{32}$	$\frac{23}{32}$
B.	·505	$\frac{5}{25}$ = ·200	·447	5·00	5·50	9·00	$\frac{11}{16}$	$\frac{15}{16}$
C.	·564	$\frac{1}{4}$ = ·250	·500	5·75	6·25	10·00	$\frac{3}{4}$	1·0
D.	·798	$\frac{1}{2}$ = ·500	·708	8·00	9·00	14·00	1	$1\frac{3}{8}$ British Standard.
E.	1·000	·785	·886	10·00	11·00	17·75	$1\frac{5}{16}$	$1\frac{3}{4}$
F.	1·129	1·000	1·000	11·25	12·50	20·00	$1\frac{1}{2}$	2

All Bars geometrically proportional.

Appendix I—*continued.*

Appendix I—*continued.*

Turned Bars.

Not proportional to Standard "D."

Standard Specimen.	Diameter.	Area, a.	$\sqrt{a}$.	Lg. = $4\sqrt{a}$.	L = $4{\cdot}5\sqrt{a}$.	L = $10\sqrt{a}$.	$d_1 = 1{\cdot}5\sqrt{a}$.	$d_2 = 2\sqrt{a}$.
		sq. in.					in.	
G.	·564	$\frac{1}{4}$ = ·250	·500	2·00	2·25	5·00	$\frac{3}{4}$	1 inch. (Short bars for Tyres, Axles, &c.)

Cheaper Turned Bars for Commercial Testing.

Not proportional to Standard "D."

Standard Specimen.	Diameter of gauge Length.	Area, a.	$\sqrt{a}$.	lg. = $11{\cdot}3\sqrt{a}$.	Between Grips.	d_2.
						in.
H.	1·000	·785	·886	10·00	11·5	$1\frac{1}{2}$
J.	1·129	1·000	1·000	11·25	13·0	$1\frac{3}{4}$

Appendix II.

Table II.—Round Bars

Rough specimens: Parallel for full length.

Diameter.		Diameter.	Area, a.	$\sqrt{a}$.	Lg. = $11{\cdot}3\sqrt{a}$. (Say)	L between Grips = $16\sqrt{a}$ (say)
in.					inches.	inches.
$\frac{1}{4}$	...	·250	·049	·221	2·50	3·5
$\frac{3}{8}$	...	·375	·110	332	3·75	5·5
$\frac{1}{2}$	...	·500	·196	·443	5·00	7·0
$\frac{5}{8}$	..	·625	·307	·554	6·25	9·0
$\frac{3}{4}$	...	·750	·442	·665	7·50	10·5
Rough turned $\frac{13}{16}$ bare	...	·798	·500	·707	8·00	11.25 Standard.
$\frac{7}{8}$	...	·875	·601	·776	8·75	12·5
1	...	1·000	·785	·886	10·00	14·0
$1\frac{1}{8}$	...	1·129	1·000	1·00	11·25	16·0
$1\frac{1}{4}$	...	1·250	1·227	1·106	12·50	17·5
$1\frac{3}{8}$	...	1·375	1·485	1·218	13·75	19·5

Appendix III.

Table III.—Eskbank Open Hearth Steel.

Steel for Rail Connections. 60 lb. Fish-plates.

Test No.	Diam. on lg.	Area.	Gauge length, lg. on adopted Standard.	Gauge length = $11{\cdot}3\sqrt{a}$.	Ratio $\frac{\text{length.}}{\text{Diameter.}}$	Ultimate tensile stress, lb. per sq. in.	Tons per square inch.	Elastic limit, lb. per square inch.	Elastic ratio.	Elongation on gauge length per cent.	Contraction of area per cent.
Results of Testing $1\frac{1}{2}$ *in. Round Bars made from one charge, A.60.*											
334	·798	·500	8·00 } Stand.	7·98	10·0	75,700	33·8	40,840	53·9	21·87	38·0 } Standard "D"
335	·798	·500	8·00 } "D."	7·98	10·0	77,200	34·4	44,340	57·4	22·62	32·4 } (British Standard)
336	564	·250	6·00	5·64	10·0	76,640	34·2	44,680	58·3	22·90	40·0 } Geometrically proportional to Standard "D."
337	·564	·250	6·00	5·64	10·0	77,000	34·3	43,000	55·8	23·70	44·0 }
332	·700	·385	7·00	7·00	10 0	76,648	34·2	46,778	61·3	21·40	38·9 }
333	·700	·385	7·00	7·00	10·0	76,675	34·2	44,675	58·2	21·85	38·9 }
					Average	76,644	34·2	...	...	22·39	38.7
Test Bars not Proportional to Standard "D." Made from same Steel.											
				G.L. = $9{\cdot}67\sqrt{a}$							
328	·700	·385	6·00	6·00	8·57	77,402	34·5	44,675	57·7	23·40	38 9
329	·700	·385	6·00	6·00	8·57	77,403	34·5	44,416	57·4	21·86	35·6
					Average	77,402	34·5	...	...	22·63	37·25
Test Bars Specified for Fish-plates. Public Works Department. Made from same Steel.											
				G.L. = $4\sqrt{a}$							
338	·564	·250	2·00	2·00	3·55	77,600	34·6	44,800	57·7	29·50	40·00 } Not proportional
339	·564	·250	2·00	2·00	3·55	77,600	34·6	44,560	57·4	28·75	40·00 } to Standard "D"
					Average	77.600	34 6	..	...	29·12	40·

Appendix IV.

TABLE IV.—"Lowmoor" Iron.

Experiments made at Government Testing Office, Lithgow, on Test-bars of varying gauge length.
All tests made from one bar 1½ in. round Lowmoor Iron, purchased in Sydney market, May, 1908.

	Bar turned to Standard.	Size.	Area.	Total Stress. Lbs. per sqr. inch.	Total Stress. Tons per sqr. inch.	Yield Point. Lbs. per sqr. inch.	Gauge Length (inches).	Total Elongation on Gauge Length per cent.	Total Elongation on Gauge Length, measured symmetrical with Fracture. See Appendix.	Per cent. on lg.	Contraction of area per cent.	Elastic Ratio.
305	A	d ·399	·125	44,960	20·07	27,048	4·00	27·50	a+b =1·5000 (c+d)²=2·4686 e+f =1·1718 5·1404=	28·51	56·00	60·1
306	B	d ·505	·200	48,250	21·54	30,397	5·00	29 68	a+b+c+d+e =4·218 (f×2) =1·500 g = ·781 6·499=	29·98	54·00	63·0
307	C	d ·560	·246	51,260	22·88	33,114	5·75	28·69	a+b+c+d+e =4·790 (f×2) =1·780 g = ·870 7·440=	29·39	51·60	64·6
308	D	d ·798	·500	48·160	21·05	30,726	8·00	27·34	f+g+h =4·100 (d+e)² =5·000 c =1·230 10·330=	29 15	50·40	63·8
309	E	(d 1·00) Actual d ·98	(·785) ·7543	49,844	22·25	25,000	10·00	30·00	Tested at Sydney University.	30·00	53·12	66·49
310	F	(d 1·129) Actual d 1·06	(1·000) ·8824	49,410	22·06	28,500	11·25	25·00	Do do ...	30·31	50·46	65·36
				Average..21·64					Average.....	29·56	...	...

Bars standards A, B, C, D, E, F, geometrically proportional $lg = 11{\cdot}3\sqrt{a}$ approx.

NOTE.—All the above bars were turned from one 1½ in. dia. bar. It will be noted that the elongations are slightly less on the test pieces turned to small dia. out of the centre of bar.
E and F being full-size bars, with minimum turning, have the maximum elongation. The difference is, however, trifling, the greatest being 1·8 per cent.

The following bars cut from same bar of Lowmoor Iron, as used above.
Turned to Forms.
Not geometrically proportional with above standards, A to F.

311	G	d ·564	·250	48,560	21·67	25,400	2·00	41·10	c+d+e+f+g+h=2·2·0 (b×2) = ·640 2·840=	42·00	52·4	52 3
312	H	d 1·00	·785	44,489	19·85	23,623	10·00	29·68	a+b+c+d+e+f=9·968 (g×2) =3· 12·968=	29·68	39·00	53·1
313	J	d 1·129	1·000	45,280	20·21	22,720	11 25	26·40	Bar broken centrally	26·40	52·10	50·1

Appendix V.

TABLE V.—Round Bars.

Roughly Turned on Gauge Length Only.

Original Diameter.	Turned over lg. to	Area. (a)	$\sqrt{a}$.	Gauge Length. $lg. = 11{\cdot}3\sqrt{a}$.	Turned Length. $T = 14\sqrt{a}$.	Lengths between Grips. (Ends not turned). $L = 18\sqrt{a}$.
"p" ¼in.	·203	·032	·180	2·00	2·50	3·25
"q" ⅜ ,, ...	·250	·049	·221	2·50	3·00	4·00
"r" ½ ,, ⅝ ,, ...	·400	·125	·354	4·00	5·00	6·50
"s" ¾ ,, ⅞ ,, ...	·600	·282	·531	6·00	7·50	9·50
"t" 1 ,, 1⅛ ,, ...	·798	·500	·707	8·00	10 00	12·75
"u" 1¼ ,, 1⅜ ,, ...	1·129	1·000	1·000	11·25	14·00	18·00

Appendix VI.

(*a*) TABLE VI.—Acid Open Hearth Steel.

(Professor Harbord.)

Test No.	Elastic Limit tons per sq. in.	Elastic Ratio.	Ultimate Stress tons per sq. in.	Elongation on 6 ins. per cent. ratio $\frac{L}{D}$ 8·57.	Reduction of Area per cent.	Composition.				
						C.	Mn.	Si.	P.	S.
30	13·64	53·59	25·25	29·23	62·30	·132	·400	·026	·055	·031
31	14·40	54·96	26·20	29·80	61·80	·128	·530	·021	·058	·041
32	13·17	43·50	30·34	27·20	57·41	·183	·710	·037	·052	·024
33	14·29	42·84	33·35	23·26	52 04	·311	·575	·040	·052	·021
34	16·55	44·72	37·00	21·76	45·51	·370	·800	·062	·029	·021

(*a*) TABLE VII.—Basic Open Hearth Steel.

43	12·99	48·50	26·78	25·56	43·59	·230	·450	·009	·054	·047
45	17·00	50·00	34·00	22·40	45·10	·355	·490	·014	·071	·046
46	17·72	51·61	34·37	22·13	44 63	·360	·900	·010	·018	·028
47	18·50	52·85	35·00	20·90	45·10	·370	·660	·016	·054	·047
48	18·83	51·87	36·30	21·86	47·59	·368	·625	·039	·040	·044
49	17·40	44·36	36·97	18·76	43·80	·420	·575	·037	·041	·037
50	19·90	51·55	38·60	16·40	40·10	·430	·610	·028	·058	·041

Length of Gauge Parallel ... 6 inches. $\frac{\text{Length}}{\text{Ratio Diameter}} = 8{\cdot}57$

Original Diameter ... ... 0·7 inch.

Original Area ... ... ·385 sq. inches.

$\sqrt{a} = {\cdot}621$

gl. $= 9{\cdot}67\sqrt{a}$

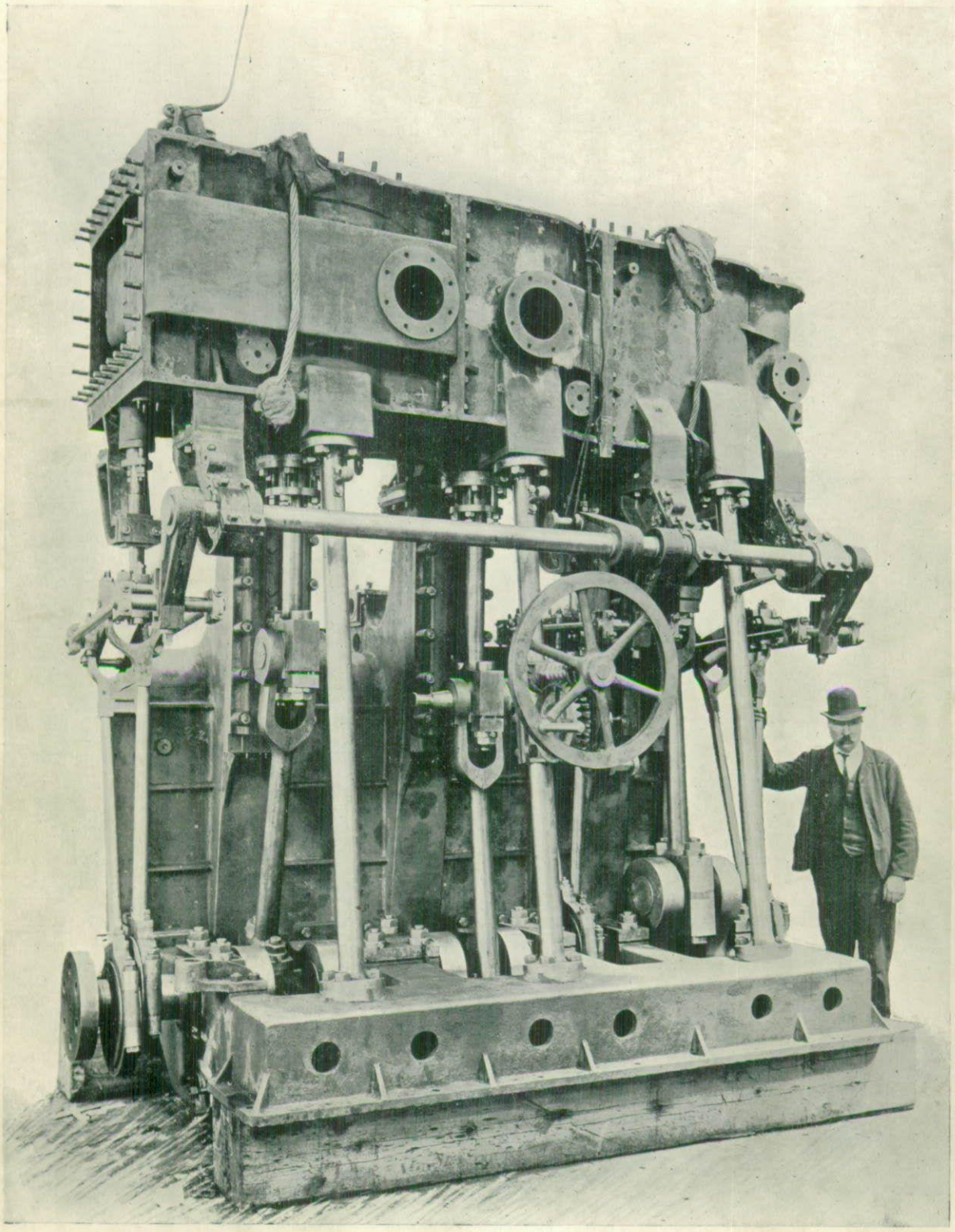
Appendix VII.

TABLE VIII.—Experiments made by David Kirkaldy, London, to ascertain the Elastic and Ultimate Strength o Wrought Iron Bars of various Sizes for the India Store Department.

Test. Number.	Description.	Original Dimensions.		Stress in lbs. per sq. in.	Stress tons per sq. in.	Limit of Elasticity. lb. per sq. in.	Length under Test.	Extension set at—			Contraction of Area per cent.	Elongation per cent. in 10 in.	Elast Ratio
		Size.	Area.					lb. 30·000 per cent.	lb. 40·000 per cent.	lb. 50·000 per cent.			
	"Farnley" Iron.												
K. 3023	3¾ in. d. rolled	2·257	4·00	53,828	.....	26,200	10	0·51	3·61	8·4	35·0	19·2	48·
K. 5011	3 ,, ,, ,, ...	1·954	3·00	55,253	.....	27,500	10	0·49	3·61	10·1	40·3	27·4	49·
K. 5010	2 ,, ,, ,, ...	1·261	1·25	57,745	.....	28,900	10	0·38	2·88	7·3	48·0	28·5	50·
K. 5809	2 ,, ,, ,, ...	1·382	1·50	60,780	.....	29,400	10	0·40	2·51	5·8	36·6	24·3	48·
K. 5808	2 ,, ,, ,, ...	1·382	1·50	58,420	.....	30,500	10	0·00	2·98	6·9	47·6	26·1	52·
	"Lowmoor" Iron.												
M. 949	2½ in. d. rolled	1·597	2·00	51,905	23·1	24,900	10	1·48	4·51	13·3	42·5	24·3	47·
M. 948	2½ ,, ,, ,, ...	1·597	2·00	51,430	22·9	23,800	10	1·54	4·79	16·2	45·3	29·5	46·
M. 947	2½ ,, ,, ,, ...	1·597	2·00	50,875	22 2	23,200	10	1·60	5·08	16·9	44·4	29·2	45·
	"Lowmoor," hammered.			Average	... 22·7								
M. 951	4½ in. square.....	1·954	3·00	49,223	.....	24,200	10	2·03	6·11	.....	46·5	31·6	49·
M. 952	4½ ,, ,, ...	1·954	3·00	48,240	.....	23,700	10	1·71	6·28	.....	42·7	27·3	49·
M. 950	4½ ,, ,, ...	1·954	3·00	46,810	.....	25,100	10	1·42	4·72	.....	20·7	10·8	53·

In all cases the extensions were measured upon an effective length of 10 inches.

Mr. Kirkaldy adopted the system, when specimens were prepared by turning, of making the parallel length of a definite area, which he kept as large as convenient. In the bars given above, the areas have been maintained in proportion to the size of the material.

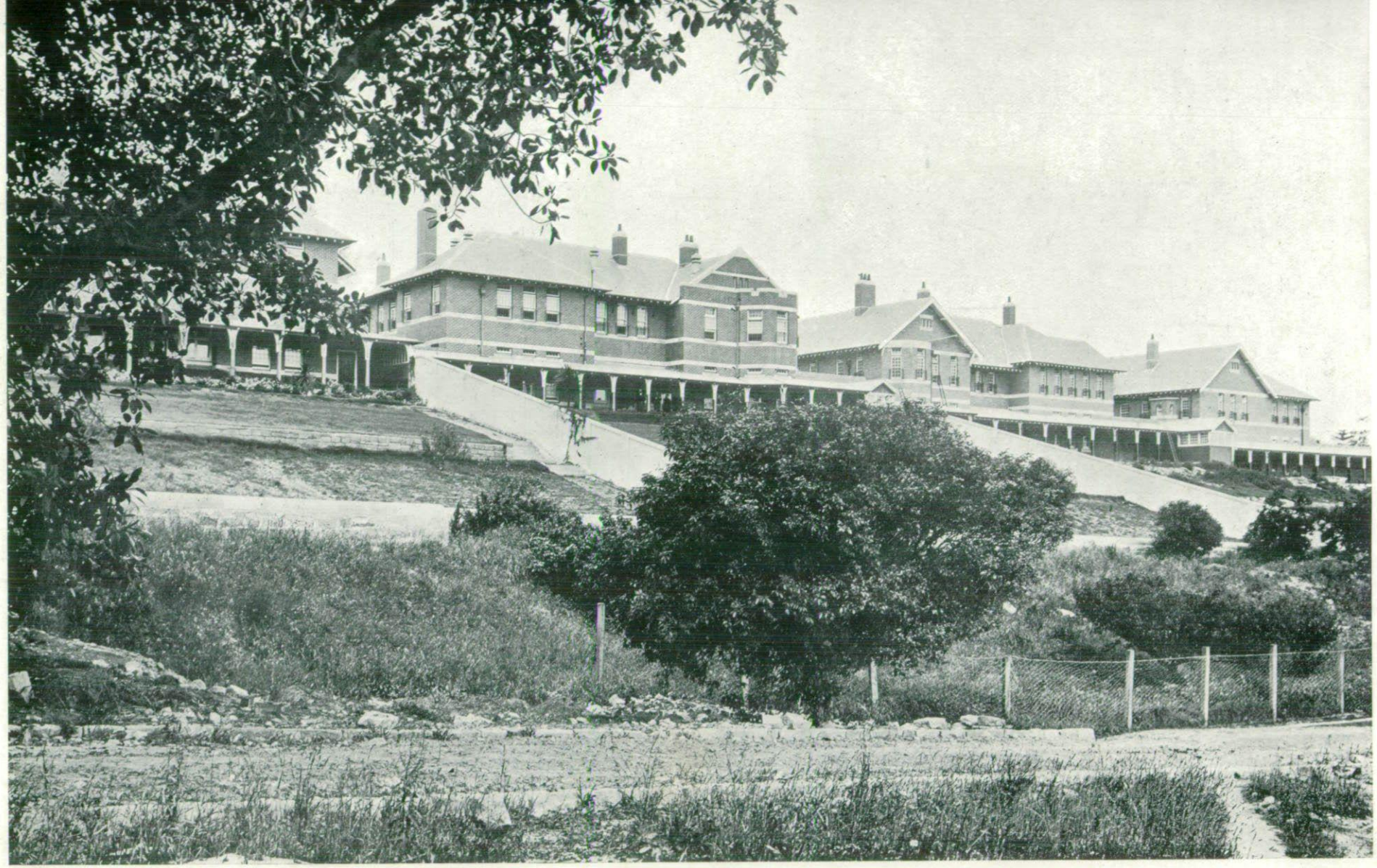


MACHINERY FISHERIES INVESTIGATION STEAMER FOR COMMONWEALTH GOVERNMENT.

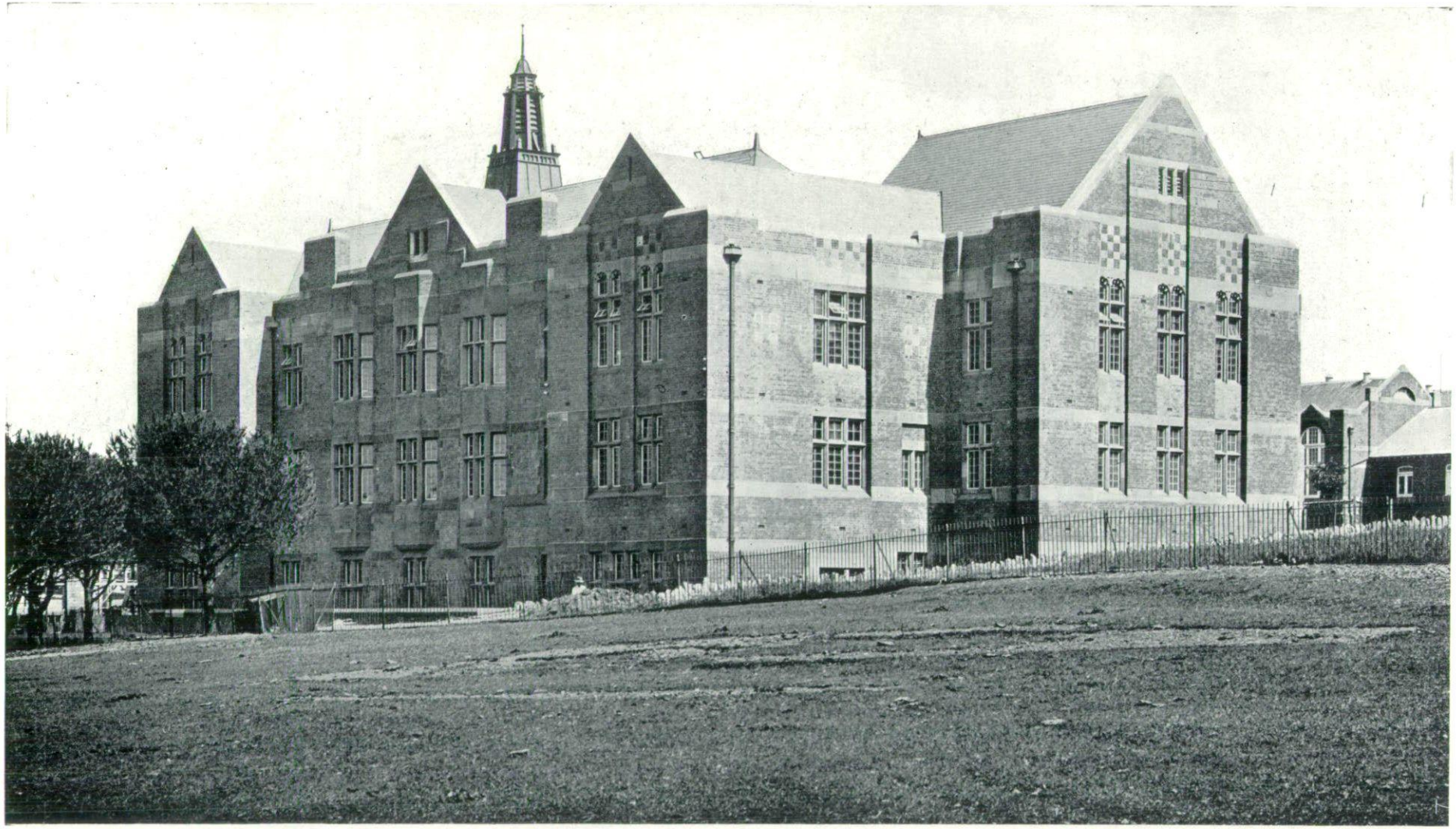
BRIDGE OVER GWYDIR RIVER AT PALLAMALLAWA.

PUBLIC SCHOOL – DRUMMOYNE

POST OFFICE, BONDI.



ADDITIONS TO GLADESVILLE ASYLUM.



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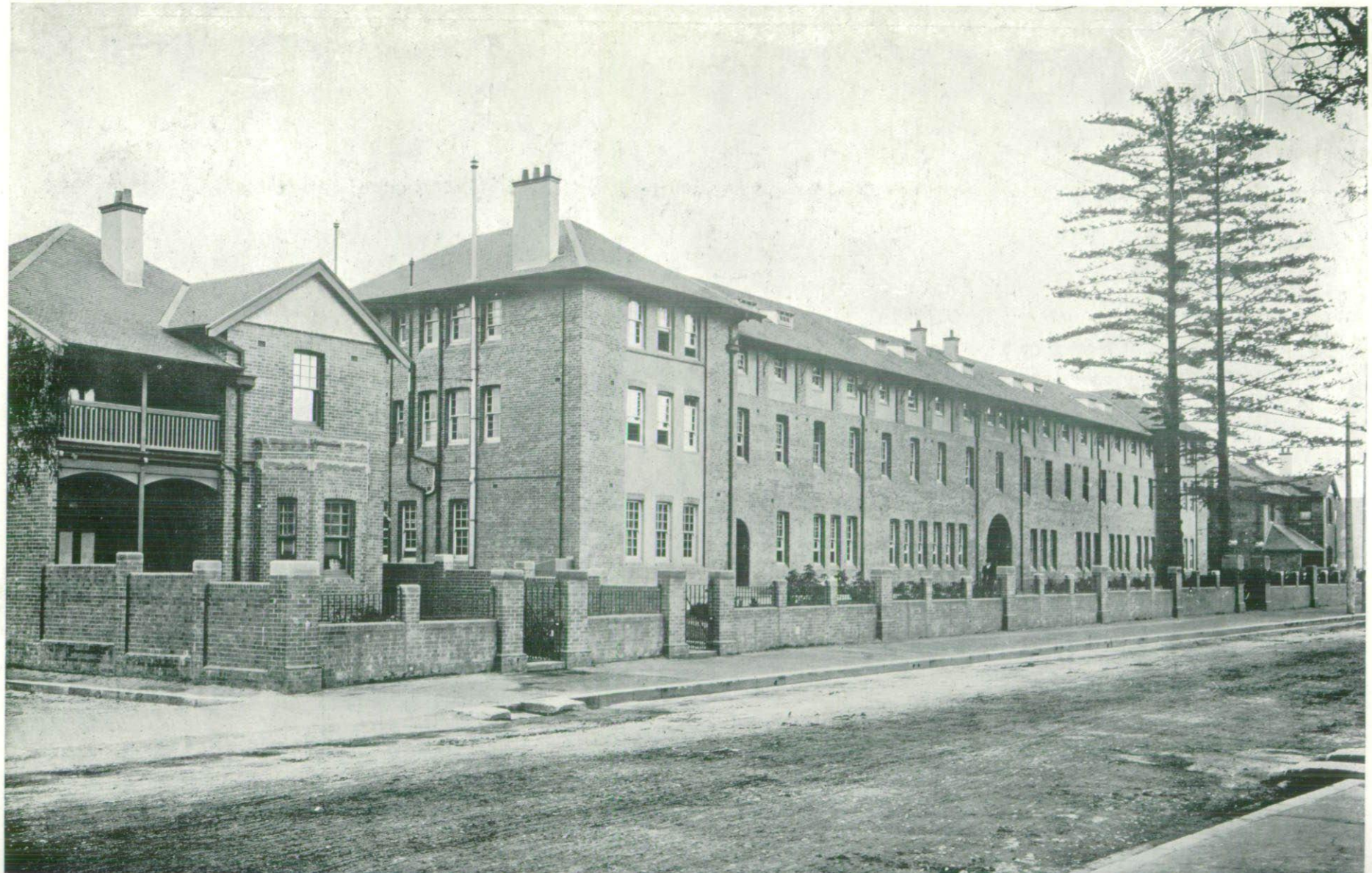

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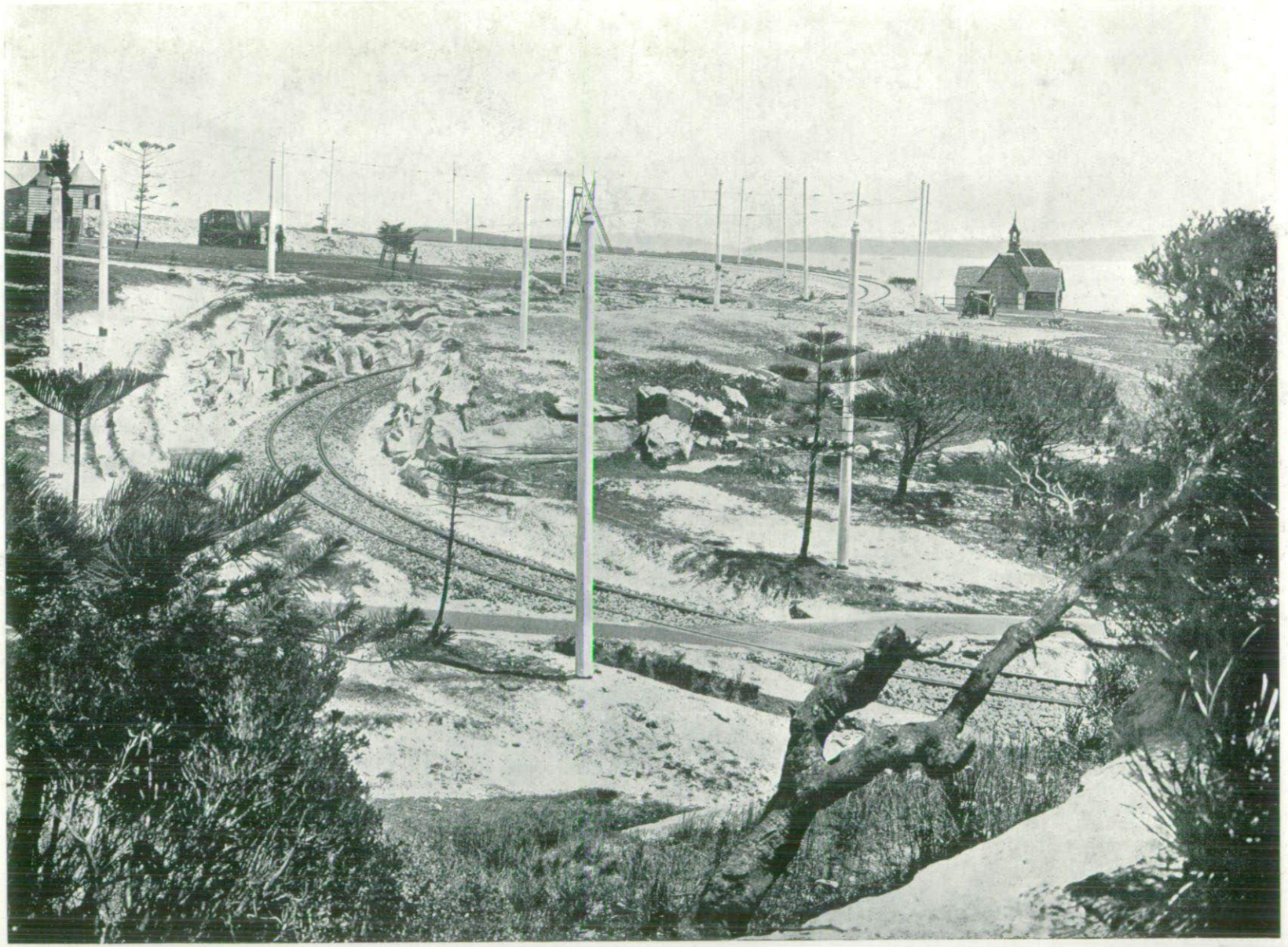
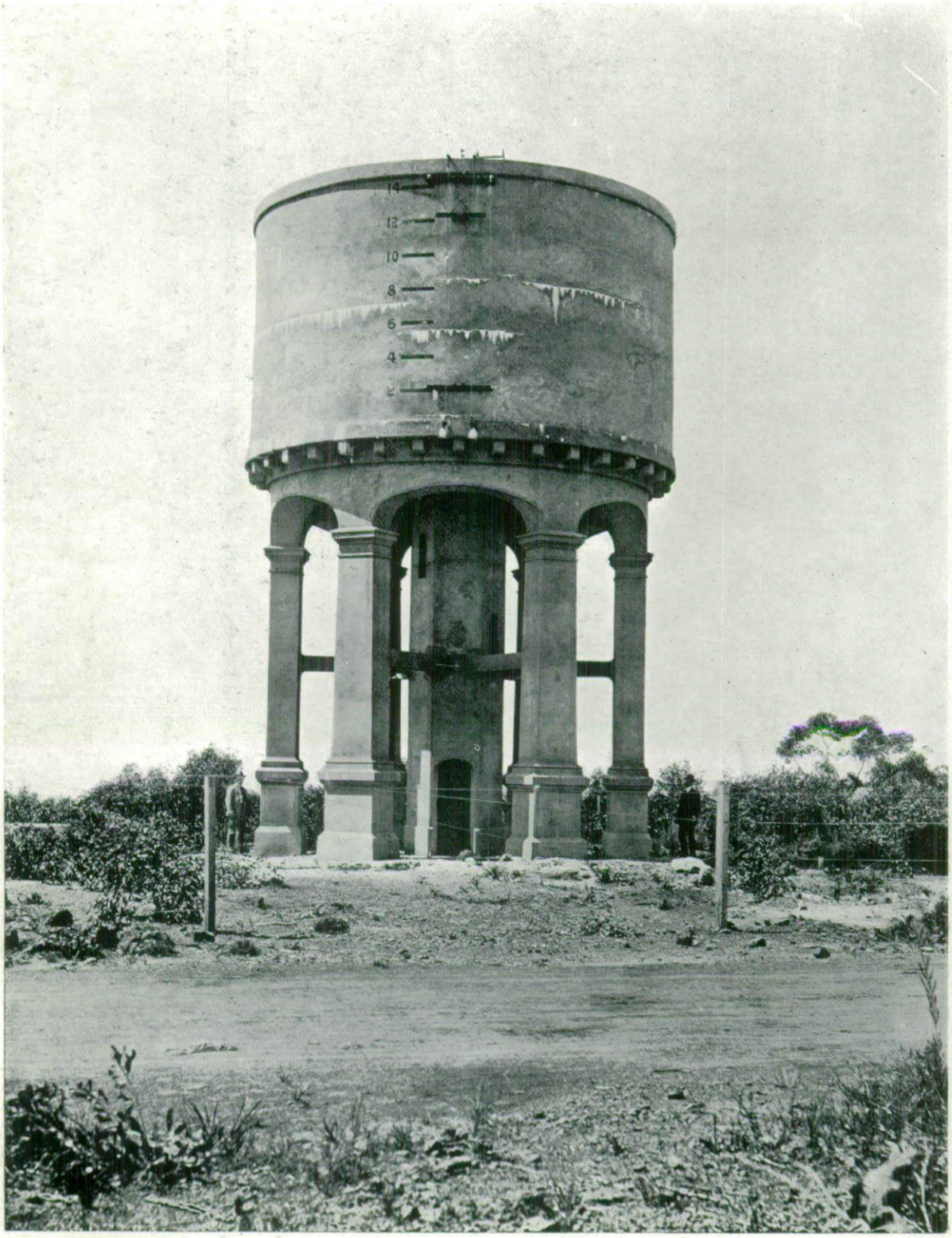
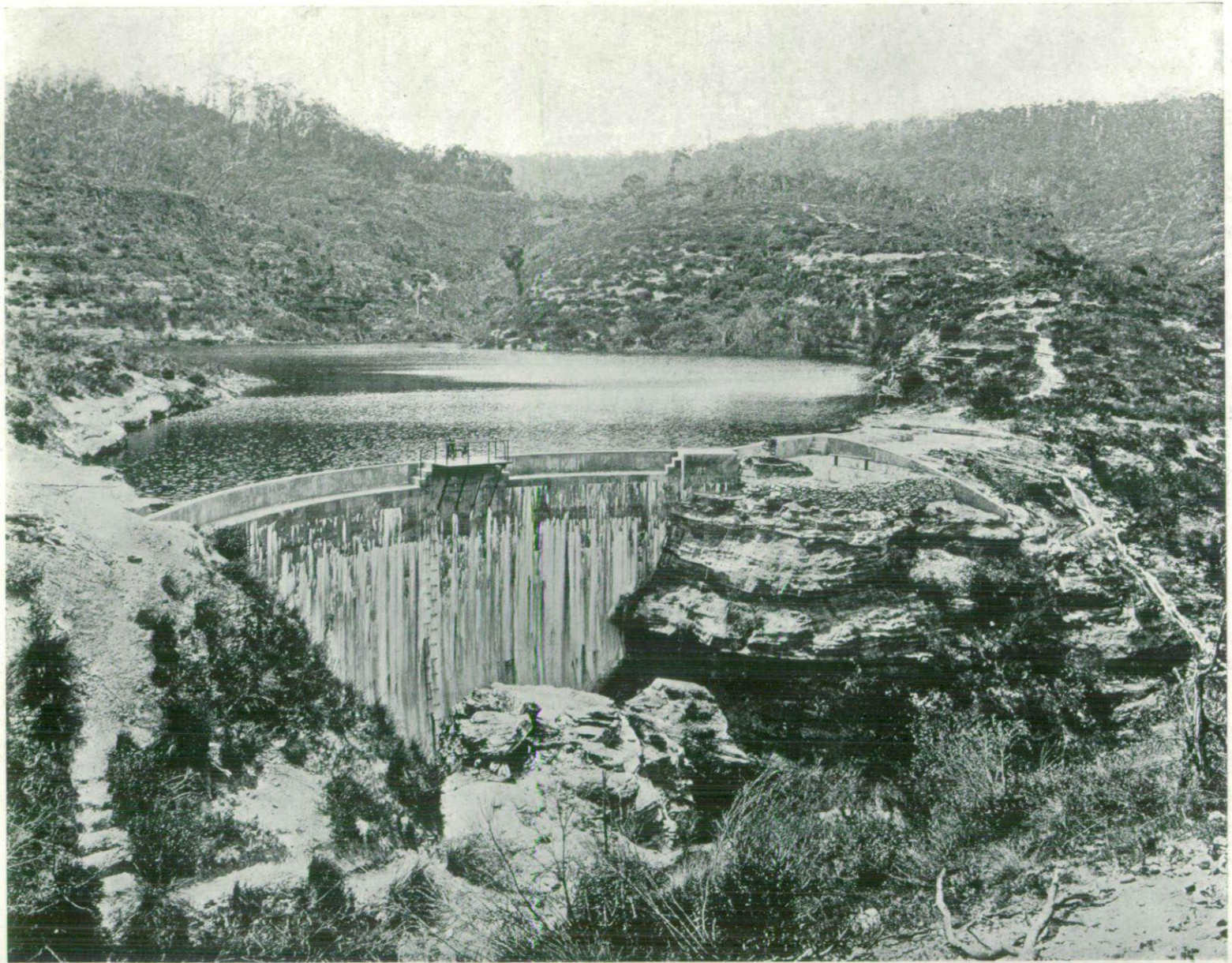


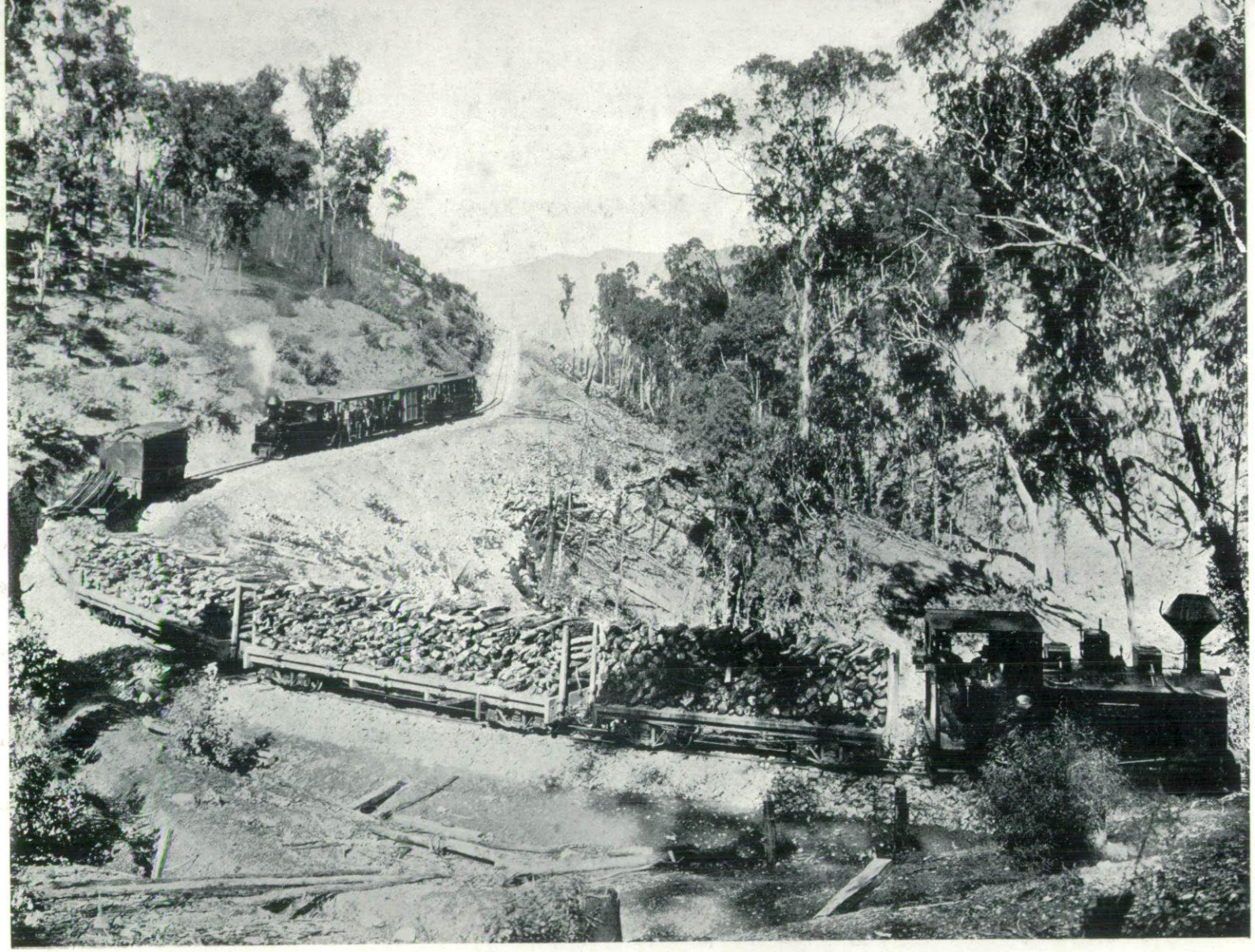
PARRAMATTA SEWERAGE.



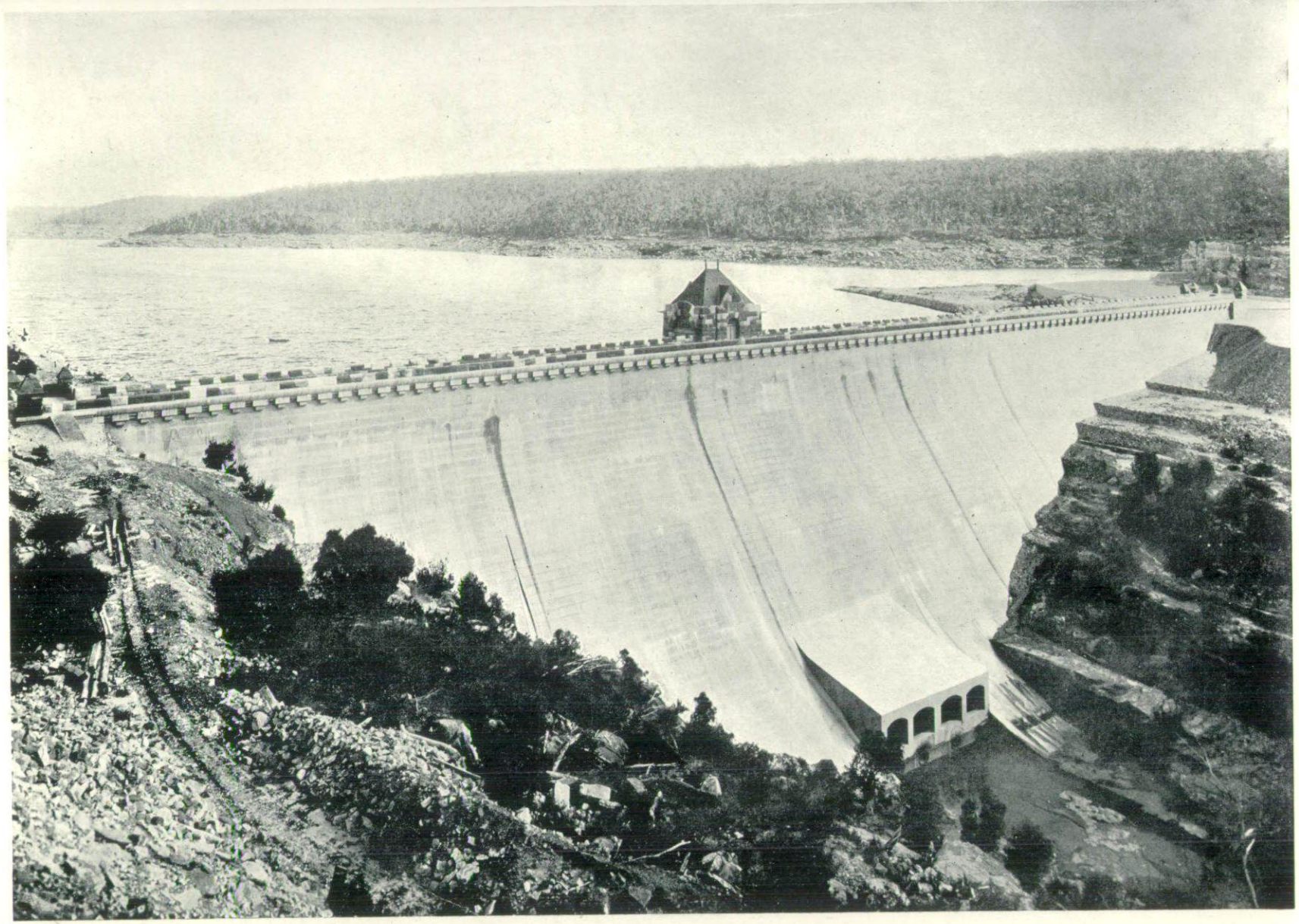
SERVICE TANK, WATERFALL.

MURRUMBIDGEE NORTHERN CANAL REGULATOR.





BARREN JACK—GOONDAH RAILWAY.



CATARACT DAM.

Appendix XII.

TABLE XII.—Eskbank Iron B.B.B. Quality. (No. 2 Test.)

Experiments made at the Government Testing Office, Lithgow, on Test-bars of varying gauge lengths.

Test-bars prepared to Standards "p," "q," "r," "s," "t," "u." Plate 2, Appendix IX.

All tests made from one bar of 1½ in. round B.B.B. Eskbank Iron.

Test No.	Bar turned to Standard.	Size.	Area.	Total Stress. lbs. per sqr. in.	Total Stress. tons per sqr. in.	Yield Point. lbs. per sqr. in.	Gauge Length. inches.	Total Elongation on Gauge Length per cent. (Ordinary Method.)	Total Elongation on Gauge Length, measured symmetrically with Fracture.		Elongation per cent. on lg.	Contraction of area per cent.	Elastic Ratio.
						Government Testing Office, Standard D. Plate 3, Appendix X.							
391	D	·798	·500	48,000	21·42	28,992	8	27·5	c + d + e + f + g + h	= 7·75			
									b × 2	= 2·46			
										10·21 =	27·62	47·6	60·4
						Partially-turned Standard Bars "q," "r," "s," "t," "u." Plate 2, Appendix IX.							
395	q	·250	·049	47,347	21·13	30,349	2·5	25·4	$(a + b + c)^2$	= 2·43			
									d × 2	= ·76			
										3·19 =	27·6	47·9	64·1
394	r	·400	·125	48,000	21·42	30,240	4	27·5	Bar broken centrally		27·5	47·1	63·0
393	s	·600	·283	47,915	21·39	30,282	6	27·5	,, ,, ...		27·5	46·9	63·2
390	t	·798	·500	48,200	21·50	32,200	8	27·5	d + e + f + g + h	= 6·54			
									c × 2	= 2·46			
									b	= 1·21			
										10·21 =	27·62	48·0	66·8
392	u	1·129	1·000	48,370	21·59	29,602	11·25	26·3	a + b	= 4·02			
									$(c + d)^2$	= 6·92			
									e + f	= 3·41			
										14·35 =	27·55	48·2	61·2
						Rough Bars as rolled. Parallel for full length. Table II, Appendix II.							
403	...	1·250	1·227	48,166	21·50	29,989	12·50	24·80	a + b + c + d	= 8·30			
									$(e + f)^2$	= 7·44			
										15·74 =	25·9	49·4	62·0
403a	...	1·251	1·230	48,050	21·44	28,830	12·50	26·70	Bar broken centrally		26·7	48·7	60·0

Area of rough bars approximate only.

APPENDIX XIII.

FORM of Test Certificate issued by the Government Testing Office, Lithgow.

STEEL and Iron. Manufactured in the State of New South Wales. Test Certificate No.....

...ting Office Order No..... Department..... .... Departmental Order No.....

....

...terial Tested .... Schedule Item No..... Schedule Test No..... Nature of Test.....

...est ...mber	Description.	Original Dimensions. Size.	Original Dimensions. Area.	Stress in Pounds. Total.	Stress Tons. Per sq. in.	Stress Tons. Per sq. in.	Apparent Limit of Elasticity. lbs.	Gauge Length. Ins.	Contracted Dimensions. Size.	Contracted Dimensions. Area.	Contraction of Area. Per cent.	Elongation. Per cent. in Gauge Length.	Ratio of Limit to Break.	Standard or other Test-bar used. Government Testing Office.
		Specified Tests.												

...ge Tests and General Report—

G. & C. Hoskins, Ltd., Lithgow, Contractors to N.S.W. Government, Manufacturers.

GOVERNMENT · TESTING · OFFICE · TEST MARK · LITHGOW

Department of Public Works, N.S.W.

....
Testing Engineer.

Date.....

To.....

.....

...te.—Unless specially marked, all Test Specimens are prepared in accordance with the proportions recommended by the Engineering Standards Committee. June, 1904. Gauge length-lg.=11·3 $\sqrt{}$ area.

[4 diagrams; 1 map; and 16 plates.]

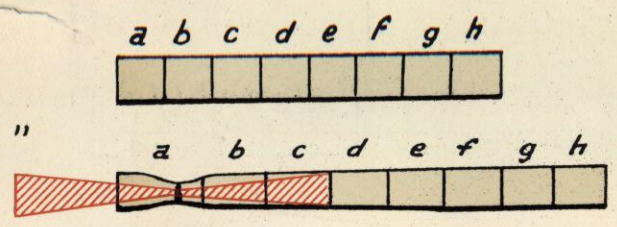
Sydney: William Applegate Gullick, Government Printer.—1909.

Tests a to f gauge length lg = 11.3√a — See table

Elongations measured as below

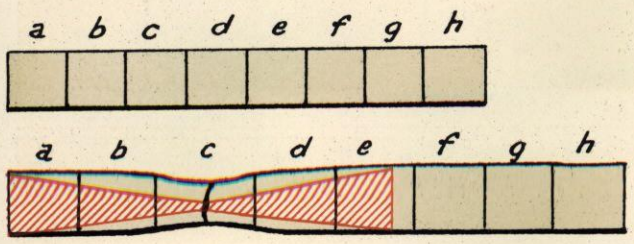
Lengths symmetrical with fracture.

"a"



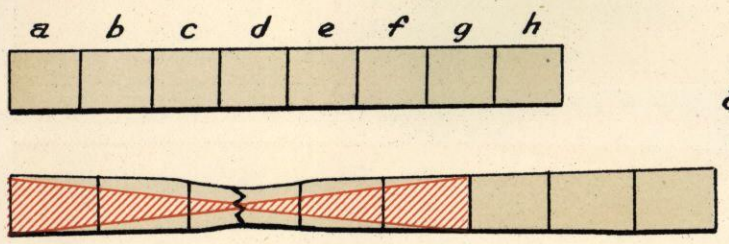
a+b = 1·5000
(c+d)² = 2·4686
e+f = 1·1718 — 5·1404 — 28·51 % on lg.

"b"



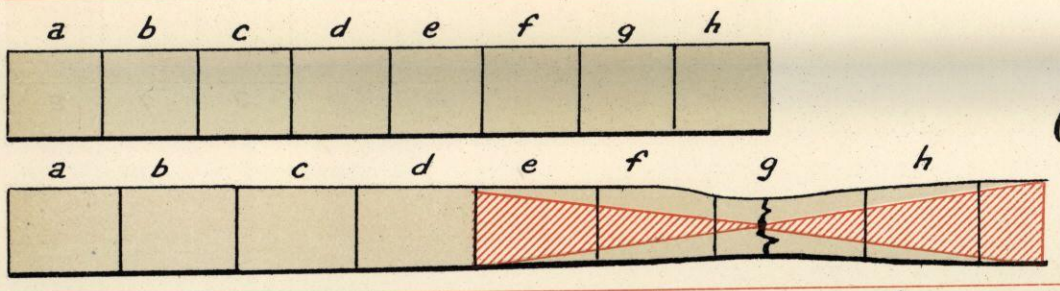
a+b+c+d+e = 4·218
f x 2 = 1·500
g = ·781 — 6·499 — 29·98 % on lg.

"c"



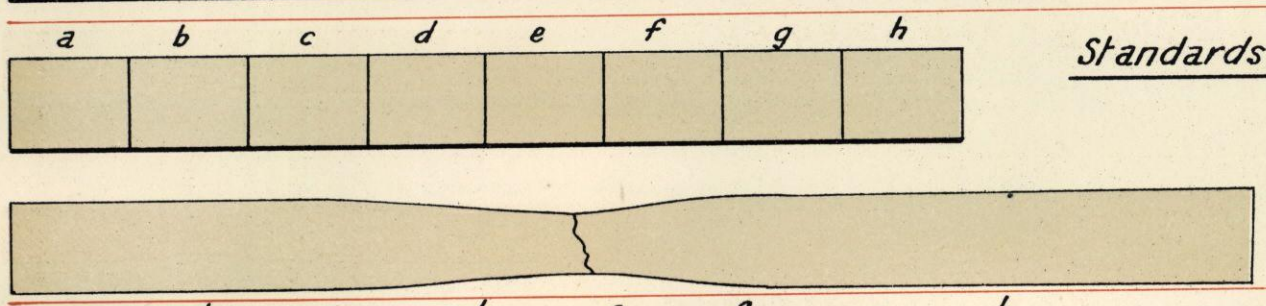
a+b+c+d+e = 4·79
f x 2 = 1·78
g = ·87 — 7·44 — 29·39 on lg.

"d"



f+g+h = 4·100
(d+e)² = 5·000
c = 1·230 — 10·330 — 29·15 % on lg.

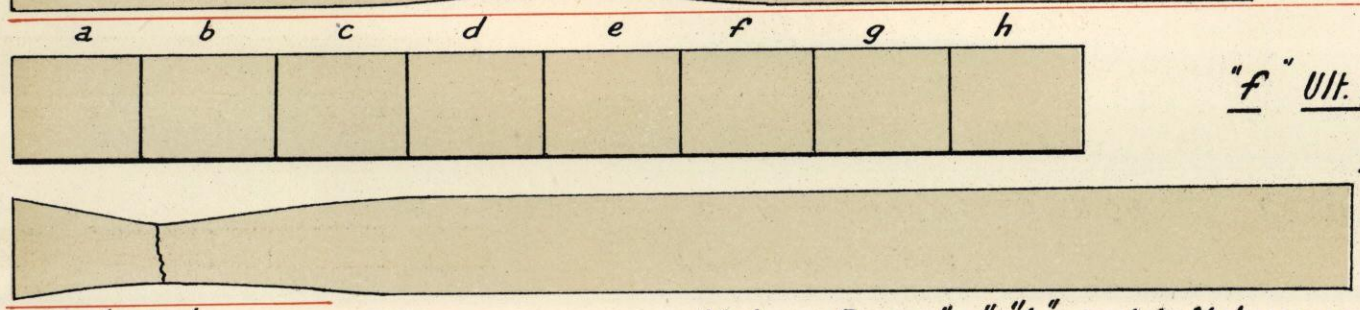
"e"



Standards "e" and "f" Tested at Sydney University.

"e". Ult. Elongation on lg = 30·00

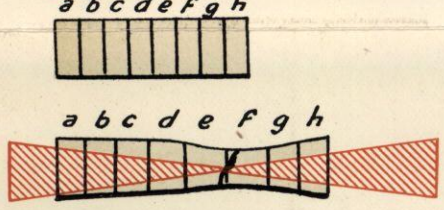
"f"



"f" Ult. Elongation, ordinary method = 25% on lg.
by Prof. Martens' method, the ult. elongation = 30·31 on lg.

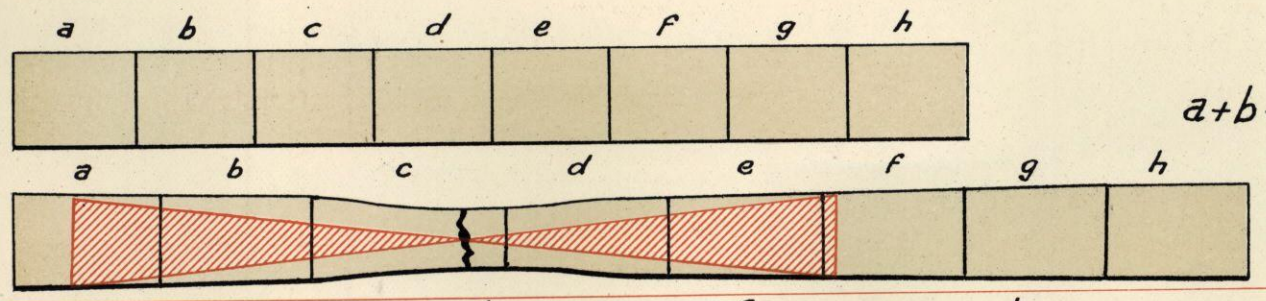
Note: Bars "g." "h" and j Not proportional with Standards "a" to "f."

"g"



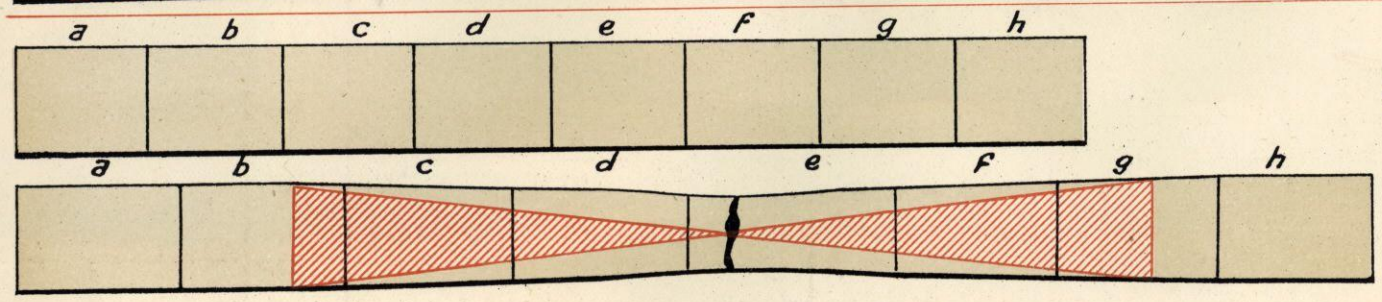
c+d+e+f+g+h = 2·20
b x 2 = ·64 — 2·84 — 42% on lg.

"h"



a+b+c+d+e+f = 9·968
g x 2 = 3·000
12·968 — 29·68 % on lg.

"j"



bar broken Centrally.
26·40 % on lg.

Standard gauge lengths, before and after Fracture.

Note: The Natural "Flow" of metal before rupture, - in the case of Mild Steel - extends over a lengh equal to about 8 times the diameter. The gauge lengh should exceed this ratio, or "flow" is retarded, and max. breaking load increased.

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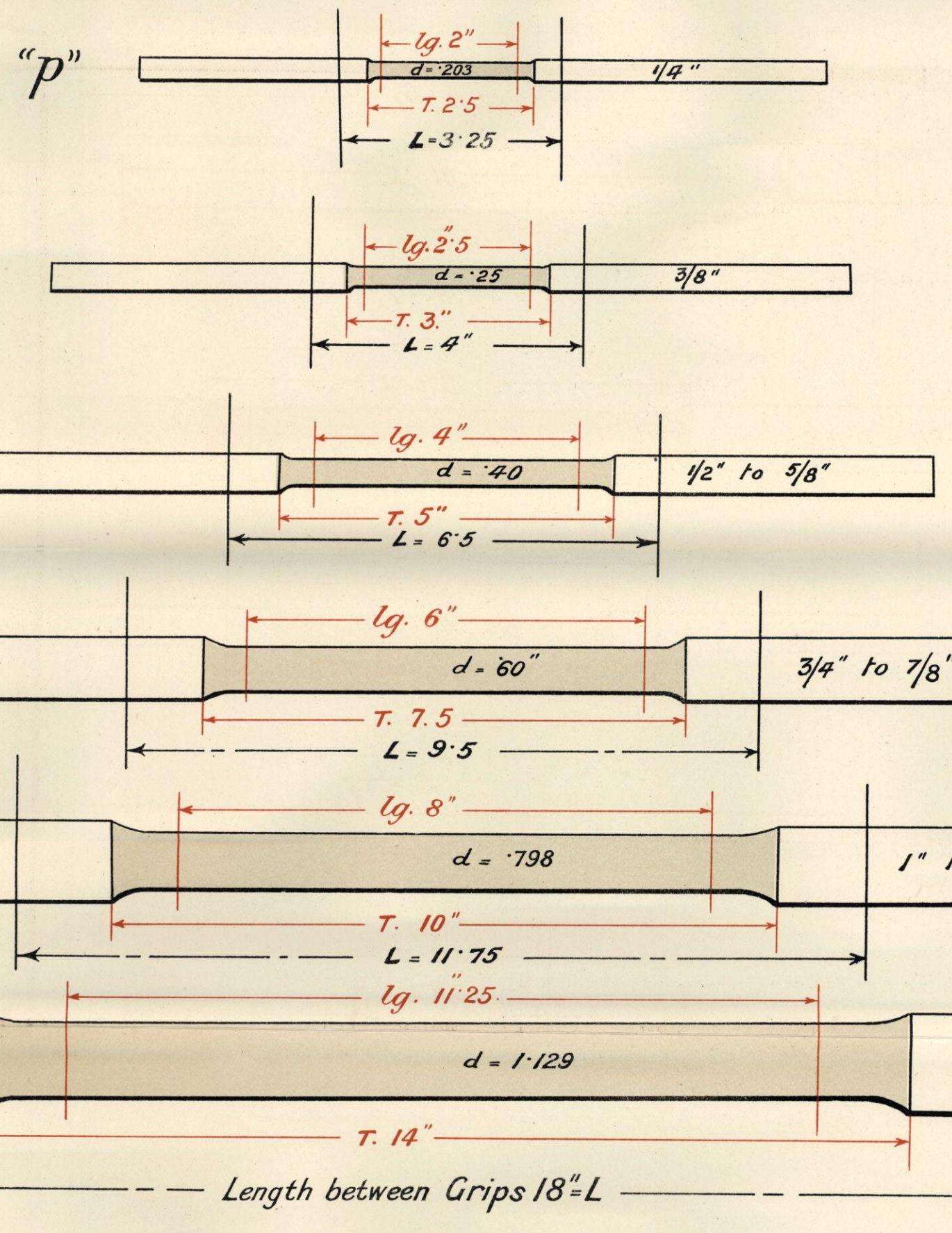

Round Bars — Partially Turned.

Rough Comparative Tests.

$lg = 11{\cdot}3\sqrt{a}$

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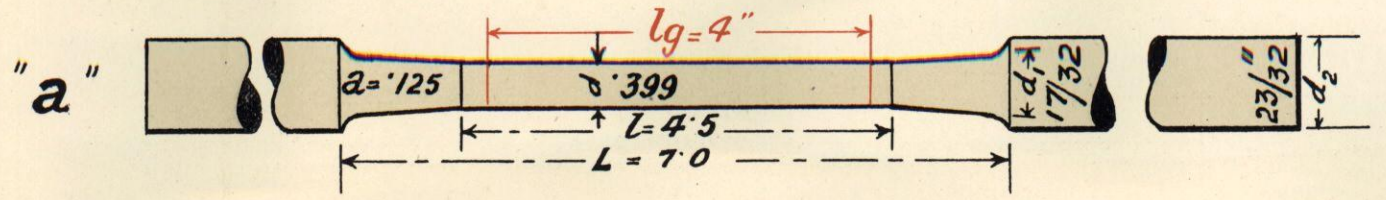
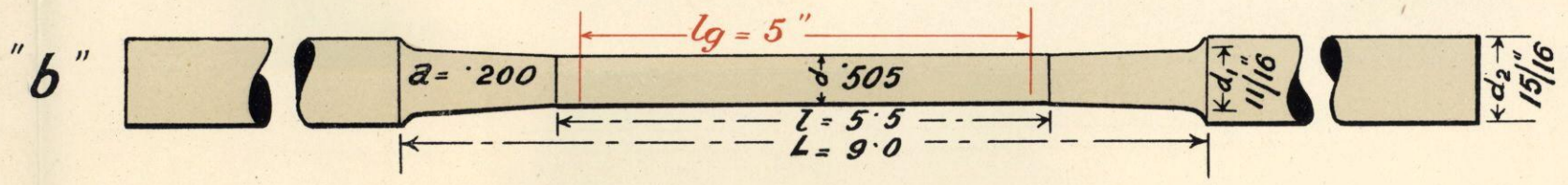
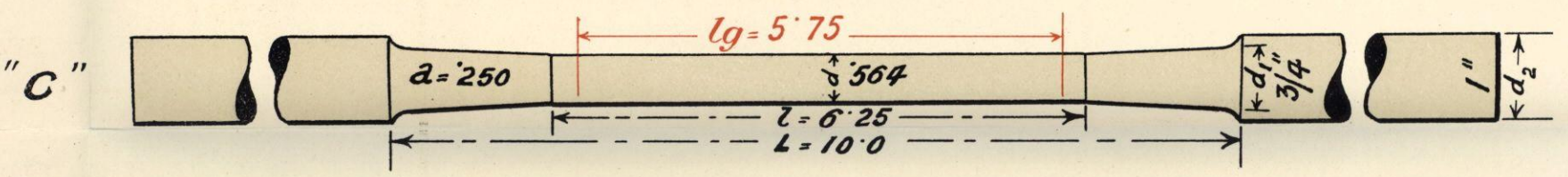
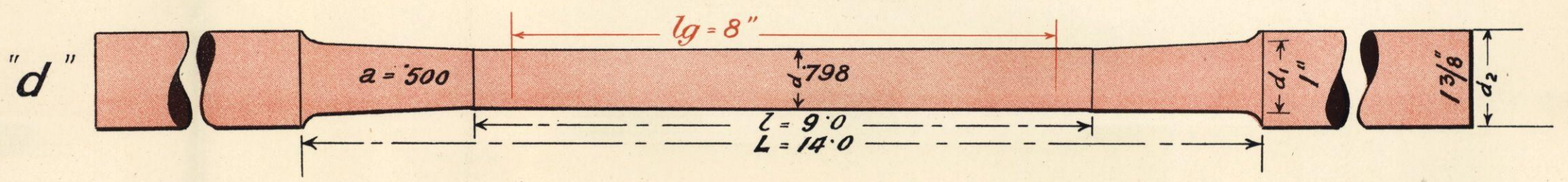
Standard Round Test Bars.

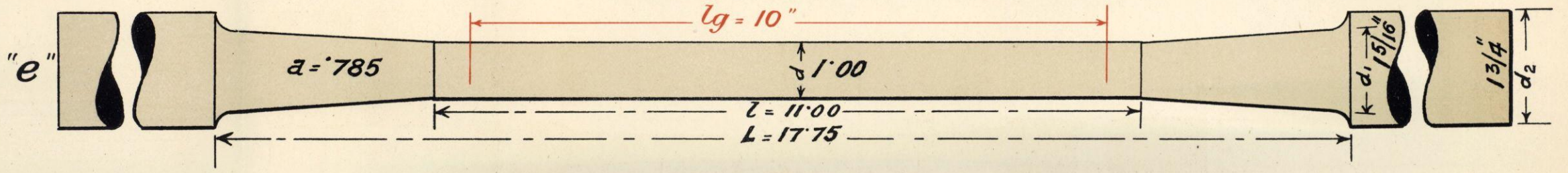
"a" to "f" Proportional to Standard "d"

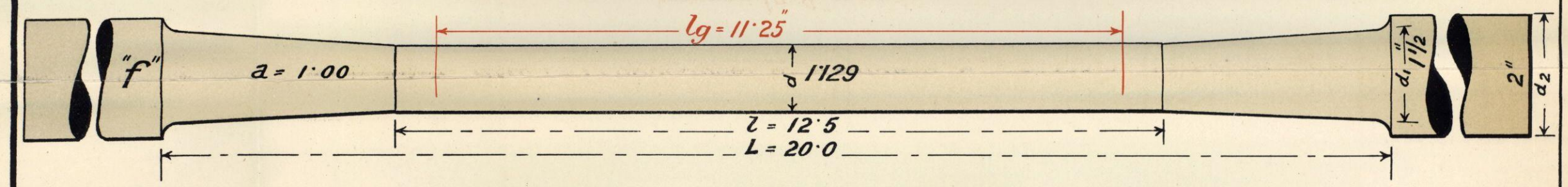


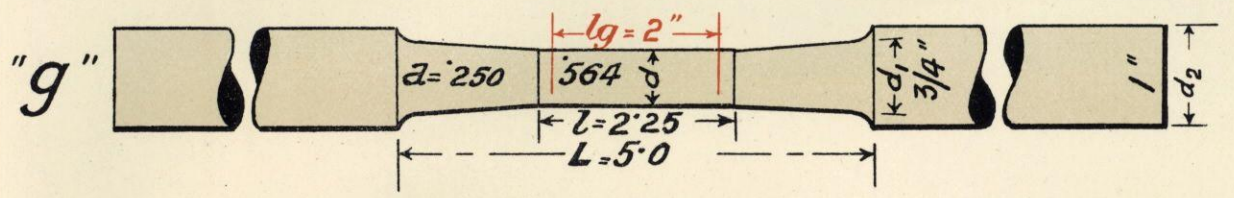




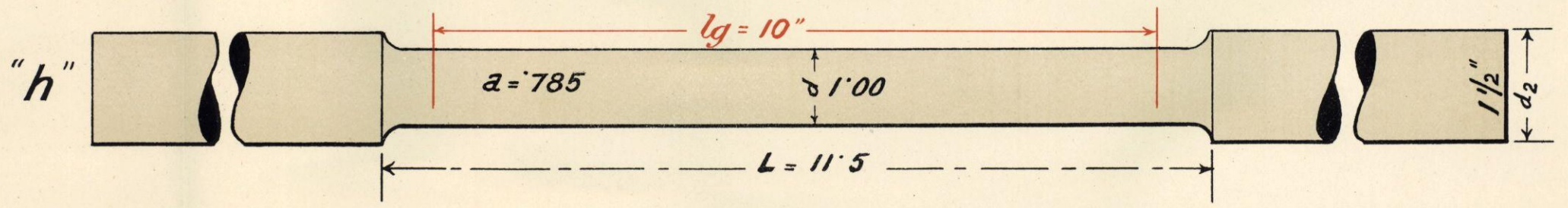


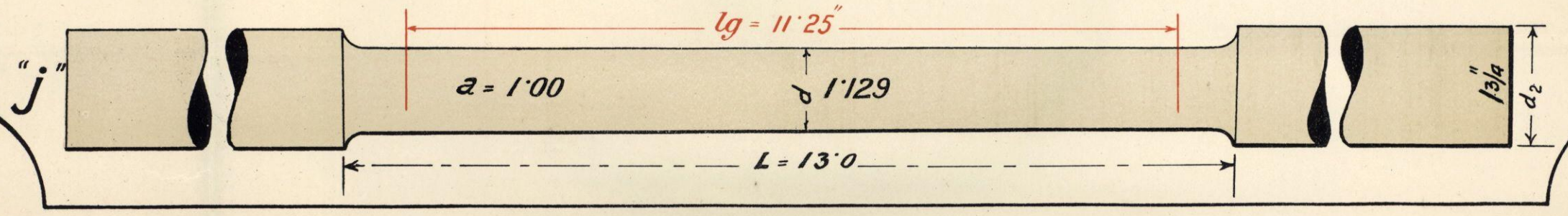






g.h.j. Not Proportional to Standard "d"





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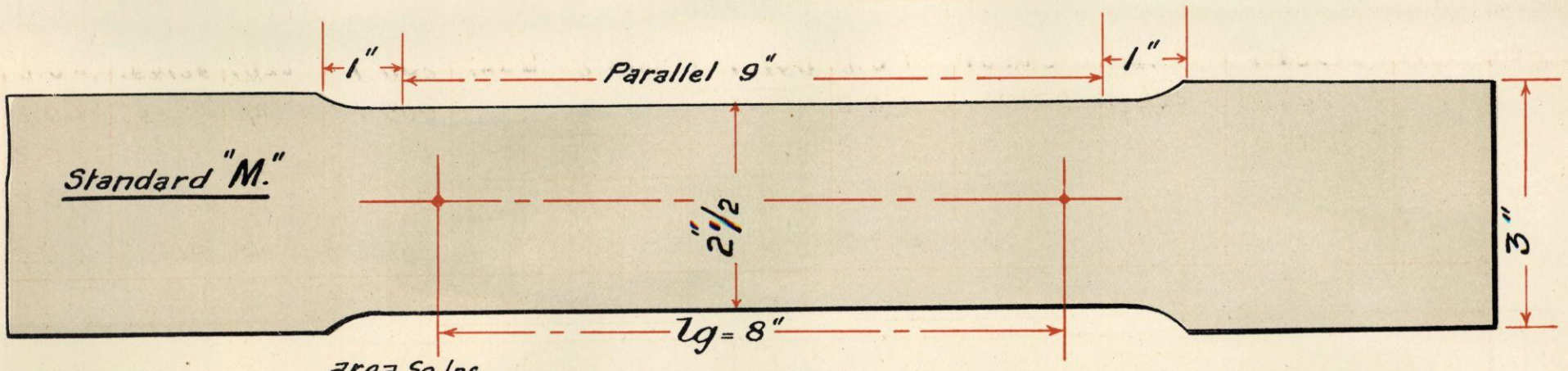
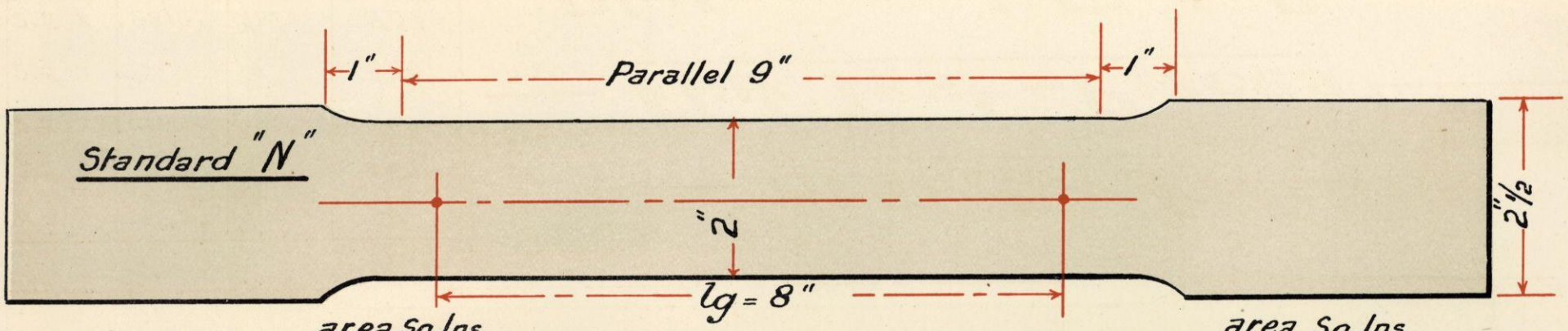
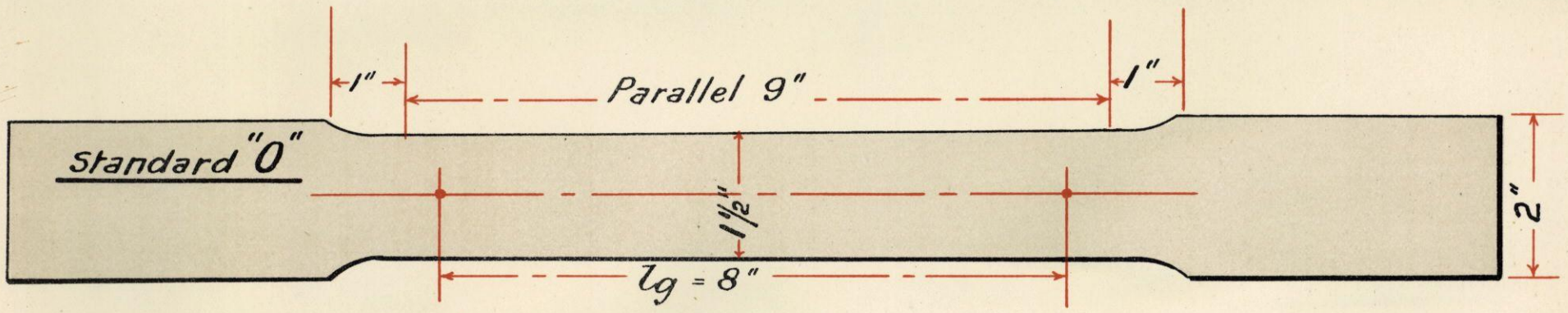
Standard Flat Test-Pieces Plates and Flat Bars.



			area Sq. Ins.
2·5 x	·15625	5/32"	·391
2·5 x	·1875	3/16"	·469
2·5 x	·21875	7/32"	·547
2·5 x	·25	1/4"	·625
2·5 x	·28125	9/32"	·703
2·5 x	·3125	5/16"	·781



			area Sq. Ins.						
2·0 x	·375	3/8"	·750		2·0 x	·65625	21/32	1·312	
2·0 x	·40625	13/32"	·812	Limit for 50 ton	2·0 x	·6875	11/16	1·375	L.
2·0 x	·4375	7/16"	·875	— machine. —	2·0 x	·75	3/4	1·500	
2·0 x	·5	1/2"	1·000	area.	2·0 x	·78125	25/32	1·562	
2·0 x	·53125	17/32"	1·062	Iron. 2 x 7/8 1·750	2·0 x	·8125	13/16	1·625	
2·0 x	·5625	9/16"	1·125	Steel 2 x 11/16 1·375	2·0 x	·875	7/8	1·750	
2·0 x	·625	5/8"	1·250	do 1½ x 29/32 1·359					



			area Sq. Ins	
1·5 x	·90625	29/32"	1·359	L.
1·5 x	·9375	15/16"	1·406	
1·5 x	1·000	1·0"	1·500	

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MAP

SHOWING THE BORE TRUST DISTRICTS CONSTITUTED AND APPLIED FOR UNDER THE WATER AND DRAINAGE ACT, AND DISTRICTS UNDER THE ARTESIAN WELLS ACT

SCALE OF MILES

0 5 10 15 20 30 40 50 60 70 80

E. M. de Burgh 30/6/08
Asst Chief Engineer for Rivers
Water Supply and Drainage

QUEENSLAND

NEW SOUTH WALES

ARTESIAN AREA

Toon
Glenelvin
Mogil Mogil
Collarindabri
Boggabilla
Macintyre River
Dumaresq River
Boomi River
Boomi
Boronga
Boobora
Euraba
Talwood
Weemabilla
Careunga
Riga
Talmoi
McGuan Ck
Thallon
Goondiwindi
Cooleearlie
Moree
Gwydir River
Great Northern Railway
Great Inn Branch
Gwydir River
Narrabri
Ashford
Inverell
Byron
Wandera
Bingara
Bundarra
Barraba
Tamworth
to Brisbane
Manilla
Somerton
Connedah
Werris Ck Junction
Quirindi
Coonamble
Gilgooma
Weetaliga
Castlereagh River
Macquarie River
Marthaguy Creek
Munna Munna
Runda
Beanbah
Wingadee
Willie
Dialgara
Brewon
Calcoin
Toolgora
Burren
Burren Junction
Bald Hill
Curley Siding
Millie
Bunyan
Nowley
Corian
Bullogorie
Baildool
Pilliga
Barraba West
Tarraman
Bogabri
Walgett
Barwon River
Darling River
Culgoa River
Bokhara River
Narran River
Warrego River
Balonne River
Weir River
Bourke
Brewarrina
Artesia
Gongolgon
Byerock
Girilambone
Nyngan
Warren
Nevertire
Trangie
Narromine
Dubbo
Wellington
Orange
Sydney
Approximate boundary
Flowing Bore of Bokhara Creek
Bore of Milchomi Creek
Bore of Bokhara Creek
Bore of Warrambool Creek
Bore of Marthaguy Creek
Bore of Macquarie River
Bore of Castlereagh River
Bore of Barwon River
Bore of Darling River
Bore of Culgoa River
Bore of Balonne River
Bore of Weir River
Bore of Warrego River
Bore of Narran River
Bore of Bokhara River
Bore of Gwydir River
Bore of Boomi River
Bore of Macintyre River
Bore of Dumaresq River
Bore of Supply Basin
Bore of Bearded Water
Bore of Flowing Water

NOTES

44 Trust Districts Constituted under the Water & Drainage Act — Shewn thus

13 Districts under the Artesian Wells Act (Currath and Killowan not shown, being West of the Warrego River) — " "

18 Trust Districts proposed under the Water & Drainage Act — " "

	Acres Watered
Riga	3,003,840
Thallon	381,230
Gilgooma	——
Total	3,385,070

Chief Survey Draftsman

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